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Sixteen men and elaborate devices are required to produce the effect.—[See page 373.]

A FIRELESS FIRE ON THE STAGE.

HOTEL PURITAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Foreign Dreadnought Developments

WITH the exception of the United States, France is the only naval power of any standing which announces the characteristics of her new warships in advance of their completion. In the majority of cases, however, the details leak out by some means or another, and in only a very few instances are the main features of large ships now under construction unknown.

The most striking point in recent dreadnought development is the increasing size and power of the gun. The British navy was the first to abandon the 12-inch gun as the main armament of dreadnoughts, and four battleships are now in commission—"Orion," "Thunderer," "Conqueror," and "Monarch"—which have ten of these weapons, firing 1,250-pound projectiles in five center-line turrets. The same caliber of gun is mounted in the four ships of the "King George V." class, and the four of the "Iron Duke" class, now completing; but the gun is of a much more powerful type. The length of the shell has been increased and 200 pounds added to its weight, much of the addition being accounted for by an increased weight of bursting charge. Another notable development in British dreadnought designs is the restitution of the 6-inch gun.

In view of the interest taken in America in the subject of the battle-cruiser, it is important to note that this type is now being "abandoned" in England. That, at any rate, is the way in which the latest development of the capital ship is generally described; but it would be equally true to say that the battleship is being abandoned and that in the future only battle-cruisers will be built. The essential difference between the two types is that the battleship has thicker armor, more guns and less speed than the battle-cruiser. Thus, to take two contemporary ships, the battleship "Iron Duke" has a 12-inch belt, carries ten 13.5-inch guns, and is designed for 22.5 knots, while the "Tiger," battle-cruiser, has a 9¾-inch belt, carries eight 13.5-inch guns, and is designed for 28 knots. The first four battle-cruisers built for the British navy were designed for 25 knots, and the "Iron Duke" class are the first battleships to be designed for more than 21.

Last year four large armored ships were included in the British programme—"Queen Elizabeth," "Barham," "Valiant," and "Warspite"—and these will represent the amalgamation of the two types. Their designed speed is 25 knots, which, if past experience goes for anything, will mean a trial speed of 27 knots. They are to carry only eight big guns, but these will be of 15-inch caliber, firing 1,950-pound projectiles; the total broadside will be 15,600 pounds, and their main belts will, it is believed, be 15 inches thick. It will be seen, therefore, that they will have the characteristic battle-cruiser armament of eight big guns, as well as a very high speed, while the only battleship feature remaining to them will be the thick armor belt. It is noteworthy that in these ships the disposition of the "Michigans'" guns will be reproduced.

The German authorities have not been very happy with their dreadnought designs. The first eight battleships built have twelve big guns each (11-inch in the first and 12-inch in the second four), but only eight in either case are available for broadside fire. In the "Kaiser" and "Friedrich der Grosse," recently completed, the number of 12-inch is reduced to ten, but there is a considerable gain in efficiency, inasmuch as all can fire on either beam, though only over a small arc, as two of the turrets are placed *en echelon*. The next group, those of the "Kaiserin" class, have twelve 12-inch, and although it is understood that there is a full broadside, the arrangement of the turrets is not known. It was not until the 1st of March last that the first German ship carrying a heavier gun than the 12-inch was launched. This was the "König," a 27,000-ton ship, which will have ten Krupp 14-inch guns, firing 1,367-pound shells in five center-line turrets, the total broadside being 13,670 pounds.

From the point of view of design, the most interesting foreign dreadnoughts now projected are undoubtedly the French battleships "Normandie," "Gascogne," "Flandre," and "Languedoc," which are to be laid down this year. These ships will be 574 feet long and 88.5 feet in beam, with a displacement of 25,200 tons, a designed speed of 21 knots, and a maximum thickness of 12.6 inches of side armor. Their main armament will comprise twelve 13.4-inch guns, representing a total broadside of 15,984 pounds, and these will be mounted in three quadruple turrets on the center-line, there being four guns abreast in each turret. There will also be twenty-four 5.5-inch guns and six submerged torpedo tubes. The three-gun turret is now a well-established feature in many navies—it has been adopted by the United States, Italy, Austria and Russia; but the interesting experiment about to be made by the French authorities will be watched with interest.

The Brazilian battleship "Rio de Janeiro," now completing at Armstrong's works at Newcastle, makes a striking contrast to these French vessels. Originally intended to carry twelve 14-inch guns on a tonnage of 32,000, the "Rio de Janeiro" was redesigned at the desire of the Brazilian authorities after she had been some months in hand, and is now to carry fourteen 12-inch on a displacement of 27,500 tons, the total broadside being 14,900 pounds. The guns will be distributed over seven turrets, all mounted on the middle line—two forward (one superposed), two amidships between the funnels, and three aft (the center one superposed). The length of the ship is 670 feet over all, and the designed speed 22 knots, but the main armor belt is only 9 inches thick. The anti-torpedo battery consists of twenty 6-inch guns.

Italy has always been noted for originality in warship design. The "Dante Alighieri," carrying twelve 12-inch on 19,400 tons, was the first triple-turreted warship to be completed, and that nation has now in various stages of construction five ships which are to carry thirteen 12-inch. Ten of these are arranged in the same manner as the 14-inch of the "Nevada" and "Oklahoma," and there is an additional three-gun turret amidships. The American arrangement referred to is reproduced exactly in the "Morosini" and "Dandolo," laid down in December, but the Italian vessels will differ in having less armor, a designed speed of 25 knots, and a displacement of 28,000 tons. A striking advance is to be made in the case of two ships to be laid down this year. For these vessels the Admiralty had under consideration two designs, one showing a ship of 28,000 tons carrying nine 15-inch in three turrets, and the other a vessel of 35,000 tons carrying twelve guns of this caliber in four turrets, 25 knots being the speed in each case. The latter design is stated to have been decided upon. Given another 800 tons these ships would be exactly twice as heavy as the "Dreadnought" of 1906. The Italians favor big ships, and their latest, if they be built, will surpass anything building or afloat, their total broadside of 23,400 pounds exceeding even that of our own "Pennsylvania," which is 16,800 pounds. She can scarcely equal the "Pennsylvania" in protection, since a large part of her big displacement must be allotted to the powerful motive power necessary to drive her at 25 knots.

Life Without Heat

AT a time when the sad fatality that has befallen the British Antarctic expedition brings home to our minds in a dramatic fashion the deadly dangers which menace those who brave the terrible cold of the regions of eternal snow and ice, an additional interest invests the article of an eminent French savant who discourses to us on the beneficial effects of cold. In a recent number of the *Revue des Deux Mondes* Prof. Nordmann discusses the effects of temperatures where the cold of the polar regions would seem like the overmastering heat of an intense tropical summer—temperatures which closely approach the ultimate zero of temperature, the awful and unimaginable cold of ultra-stellar space. Prof. Nordmann points out that human beings (even the French) are a cold-blooded race, that very little heat would kill us, whereas there is reason to believe that we can stand any amount of cold. Judged from the standard of temperature set by the Universe, where stars reach a temperature of 40,000 deg. Cent., it is seen that we live on a very cold planet—we are not really much removed from the absolute zero of temperature. But although a rise of a few degrees would destroy not only all human beings, but every form of life on this planet, experiments have been conducted which show that life can successfully resist the extremest cold.

Living organisms, various bacteria and spores, have been plunged in liquid air, i. e., have been reduced to a temperature of — 190 deg. Cent., without apparently harming their vital functions. They have been subjected to the incredible temperature of liquid hydrogen — 252 deg. Cent., and even liquid helium, which is very near the absolute zero, and kept at that temperature for months. Yet on being again restored to their normal temperature they have manifested their vital activities unimpaired. At the absolute zero of temperature these organisms simply seem to go to sleep, and to continue life refreshed when they are restored to their usual surroundings. These facts have found application in the storing of vaccines, which are usually useless forty days after they are prepared. But by subjecting them to extreme cold, they may be kept for an indefinite length of time, and when required for use they manifest their properties unimpaired.

Incidentally, these experiments remove the objection, based on the cold of intra-stellar space, to the theory that life may be transported from one planet to another. We now know that living organisms can survive the extremest cold. Prof. Pictet has made similar experiments on much more highly organized creatures, such as fishes, and has obtained similar results, a fact which leads Prof. Nordmann to suggest playfully that the process may one day be applied to man himself. In that case a way of escaping our troubles when they became too much for us, would be to enter the Government refrigerator, leaving instruction that we are to be awakened in say, 200 years' time. However this may be, it is certain that these experiments will lead to many applications of importance, and that they are of much interest for many scientific theories.

Among the many industrial applications which have attended the artificial production of great cold, is the ready means it affords of obtaining large quantities of pure oxygen and pure nitrogen. Air consists chiefly of a mixture of these two gases, and the fact that they liquefy at somewhat different temperatures has been utilized to obtain them from the air, a method which is analogous to the well known one of fractional distillation so valuable to the chemist.

Oxygen liquefies at a temperature of — 182.5 deg. Cent., and nitrogen at — 193.5 deg. Cent. This slight difference of eleven degrees has proved sufficient to effect the almost complete separation of these two gases. The pure oxygen so prepared has many important uses, but one of the most novel has been discovered under the auspices of the ministry of war in France. It is found that powdered aluminium in liquid oxygen forms a high explosive, having about twice the explosive force of ordinary gunpowder, while another explosive formed of carbon in liquid oxygen is of about the same strength as dynamite. This is obviously a discovery which may have important developments.

The purity of the nitrogen obtained by liquefying air has been utilized in the formation of cyanides, which are of such importance in present day agriculture. The other constituents of the air, argon, crypton, neon, xenon and metargon, are also obtainable by this fractional liquefaction process. Neon, which is so rare that in 65,000 parts of air only one part is neon, may be obtained in quite appreciable quantities in this way. It is well known that when an electric discharge is passed through a tube of neon, the tube emits a beautiful rosy glow. The discharge takes place very easily, a difference of potential of thirteen volts between the electrodes being sufficient, as against 1,000 volts as is required for air. But in the ordinary way the beautiful reddish glow soon fades, owing to the fact that impurities from the electrodes become mingled with the gas. A way of overcoming this has been found. One of the most remarkable phenomena which has transpired in studying the behavior of substances at low temperatures is the extraordinary absorption powers manifested by carbon at the temperature of liquid air. It will absorb gases so readily that it is one of the chief agents now used in the production of high vacua. The impurities in a neon tube are absorbed by carbon surrounded by liquid air, and this method has proved so satisfactory that it has been found practicable to utilize neon tubes as cheap illuminants in Paris. Here again is an application whose developments may prove of considerable importance. The importance of cold in preserving provisions is well recognized in America, and however much we may feel inclined to grumble at the winter, we must agree with Prof. Nordmann that cold, as much as heat, is a beneficent friend of mankind.

Removable Taxicab Upholstery.—Setting an excellent example in sanitary construction, one of the large Chicago taxicab companies has just taken delivery of a number of new vehicles in which the upholstery is removable for cleaning purposes. Instead of being attached permanently to the backs and seats of the bodies, the upholstery is attached to boards which in turn are keyed to the body. Thus it is a simple matter to remove the cushions and clean them, the operation also leaving the interior of the cab unusually accessible.

Electricity

Antennæ Strung from a Cliff.—According to a newspaper report, an Italian engineer, named Galetti, is building a wireless station under a high cliff in the village of Leschauz, near Chambery, Southeast France, with which he hopes to communicate with New York. In place of the usual vertical aerial, he has set up at the top of the cliff two posts each about 25 feet high, between which a wire is stretched. To the wire a series of other wires nearly three thousand feet long are connected and conducted to the instruments in the shack at the foot of the cliff.

Electric Vehicle Promotion in New York City.—An appropriation of $30,000 has been made by the New York Edison Company toward the establishment of an electric-car garage in New York city. This will be expended at the rate of $10,000 per year under the auspices of the New York office of the Electric Vehicle Association of America, so that there shall be no question of partiality shown toward cars of any particular manufacture. In connection with the garage there will be an active educational campaign conducted among customers and prospective purchasers of electric cars.

Fire Produced by Electric Hand Lamps.—Recently there was a fire in a theater in the city of Stettin, Germany, which was attributed to an ordinary electric hand lamp of the type provided with a wire guard. The matter was investigated and it was found that the ordinary hand lamp if provided with a 16 candle-power, 220-volt carbon filament lamp could cause a fire if brought into contact with sawdust or other equally inflammable material in such manner that there is little circulation of air to carry off the heat. But no fires resulted from tests with metal filament lamps of equal rating, although in lamps of 25 or more candle-power ignition could be obtained.

Sterilizing Swimming Pools.—For the past three years the public baths in the borough of Poplar, London, have been treated with a so-called "electrolytic fluid" which is an oxidizing fluid obtained by the electrolysis of magnesium chloride. A committee appointed by the Royal Sanitary Institute recently investigated the use of this electrolytic fluid and reported very favorably upon it. They found then that when enough of the fluid was added to the water to supply one part of free chlorine for every one or two million parts of water, the pool was kept pure and free from odor and there was no tendency for the water to deposit slimy sediments on the floor. This treatment made is unnecessary to renew the water oftener than once in a week or ten days.

The Electrical Auctioneer.—Auction sales are accompanied by a great deal of noise, and in order to do away with this an electrical method has appeared in Holland which seems quite promising, and the sales are now carried on almost in silence. It is now applied to selling eggs by auction, according to the custom which prevails in the agricultural centers throughout the country in the weekly markets. Eggs are auctioned off in 2,500 lots, and on the new plan each bidder has a numbered seat with a push button and wiring. The seller is stationed in front of a large dial having prices ranged around it from lowest to highest. There is also a large board containing like numbers which can be electrically lighted, and these are connected to the seats. After the proper announcement of the lot of eggs as to quality and weight, the seller starts the hand slowly moving around the dial. When at any figure, the buyer presses his button and the corresponding figure on the board lights up, and his number is registered by an annunciator. As the hand moves on, the next bidder can register a higher number, and so on until the bidding is finished. The method is said to work very well, and no doubt can be applied to all kinds of auction sales.

Long-distance Wireless Telephony.—The Paris daily papers state that wireless telephone messages were lately sent over a distance of more than 600 miles from Rome to Tripoli. Wireless telephony does not appear to have made any marked progress until the present time, since the well-known work of Poulson and Prof. Majorana's experiments in Italy. This latter inventor used a sensitive microphone of his own design and in this way the torpedo destroyer "Lanciera" covered 250 miles in the region of Sicily. However, the recent results obtained by Prof. Vanni of the Military Wireless Institution, near Rome, are quite remarkable, as he is able to connect with a post in Tripoli, or about 600 miles from Rome. In these experiments he makes use of a liquid microphone based upon the ideas of Chichester Bell, brother of the celebrated Graham Bell. Using a microphone of this kind together with apparatus of the Moretti type the voice could be very well heard at Tripoli, and the persons there were able to recognize the professor's voice. A still more striking effect was had by using a phonograph to deliver the voice into the telephone transmitter, and even here the words were distinguished very clearly in the African post. After improving his apparatus, Prof. Vanni hopes to telephone between Rome and Paris. Although the distance is not over 730 miles, the natural obstacles, such as mountains and forests, will make the work more difficult than in the case of the over-sea transmission.

Science

The Falkland Islands, in the South Atlantic Ocean, are a British colony with a population of over 3,000, possessing a comparatively imposing array of officials—governor, executive and legislative councils, colonial secretary, etc. They have also a bishop and a cathedral. This interesting pocket edition of a colony has hitherto had no telegraphic communication with the world, and only a monthly mail to England. Its isolation is now at an end; a wireless telegraph station has been opened at the capital and metropolis, Port Stanley (population 880). Communication with the outside world will be had only through the wireless station at Montevideo, Uruguay, 1,240 miles distant.

A Fixed Date for Easter.—This long-mooted question is discussed anew by Camille Flammarion in *L'Astronomie*. It is doubtless regrettable that an epoch in the calendar which fixes the dates of so many other events, civil as well as ecclesiastical, should be subject to such extraordinary variations in its time of occurrence. The extreme range is over a month (March 22nd to April 25th). The French astronomer points out that since for religious reasons Easter must be celebrated on a Sunday, in order that it should fall on the same date every year it would be necessary to reform the calendar as a whole—a step that he considers desirable for other reasons. Pending this consummation, however, he suggests that the range in the date of Easter might be reduced to a week; viz., from April 5th to April 11th.

Relative Land and Water Areas of the World.—In our school days we learned that water covers three fourths of the earth's surface, and land the other fourth. This statement dates back to a time when very little was known about the distribution of land and water in the polar regions, and needs to be considerably revised in the light of recent discoveries. Taking account of the results of the latest polar expeditions, Prof. Wagner estimates that the ratio between land and water is 1 : 2.42; in other words, that about three sevenths of the earth's surface is land, and the rest water. This estimate assumes that only 10 per cent of the surface north of latitude 80 degrees north is land; an assumption that may be considerably modified by the forthcoming explorations of the great unknown region north of British America and eastern Siberia.

Natural History Explorations in Borneo.—For more than ten years past Dr. W. L. Abbott, of Philadelphia, has been exploring the Malay Archipelago, and presenting all his collections in natural history and ethnology to the Smithsonian Institution. The latest annual report of the Institution announces that although Dr. Abbott has been obliged, through illness, to abandon personal participation in this admirable undertaking, he has engaged the services of a collector and provided funds for continuing the explorations he had begun in Borneo. The field work will be carried on in eastern Dutch Borneo, the natural history of which is practically unknown, and from which there are at present no collections in American museums. A rich harvest is expected.

An Investigation of Aneroid Barometers has been in progress for the past two years at the U. S. Bureau of Standards, in Washington, and will undoubtedly lead to improvements in the construction of these indispensable instruments. Intercomparisons have been made of a large collection of instruments, from twelve makers. These have been subjected to mechanical, temperature, free-air, and air-pump tests. In the last named the barometer is held at the lowest pressure for 24 hours, in order to observe what is known as the "creep." This is a defect in the action of an aneroid when subjected to a large and rapid change of pressure, consisting of a sluggish adjustment of the index to or toward the correct reading. Its determination appears to be the crucial point in ascertaining the quality of an aneroid. One result of these investigations is the development of new standard specifications for the purchase of aneroids by the Government.

Capt. Amundsen has received a grant of $20,000 from the National Geographic Society toward his coming north polar expedition. In voting this grant, the research committee of the society desired especially to increase the scientific possibilities of the undertaking, as to oceanographic research, meteorological and magnetic observations, etc. Amundsen expects to start North from the Pacific coast some time in the summer of 1914. His ship, the "Fram," which now lies at Buenos Aires, will be sent through the Panama Canal some time this summer or autumn, and it is understood that the authorities have arranged that she shall be the first vessel, other than a man-of-war, to pass through the big cut. The personnel of the coming expedition will be practically the same as that which made the recent journey to the Antarctic. After passing through Bering Strait, it is hoped that the ship will drift right across the polar basin, following the supposed route of the Melville-Bryant casks and the wreckage of the "Jeannette." In this case, the party should pass not far from the pole, and emerge from the unknown somewhere between Greenland and Spitsbergen.

Automobile

Shorter French Salon Scheduled.—At the last meeting of the French Chambre Syndicale de l'Automobile, it was resolved that the duration of the next French Salon be restricted to 10 days; the last one was open 16 days. Waning attendance during the last days and the impatience of manufacturers to return to work, are understood to have prompted the resolution.

Air Filters for Carbureters.—Despite the fact that it has been proven that much of the so-called carbon deposit that collects in cylinders is due to dust drawn in through the carbureter, the maligning of oil goes on. Modern lubricants are notably free from carbon content. To insure a proper test of a new oil it would be only fair first to fit a comparatively fine screen to the carbureter air intake. It will be found that the screen must be cleaned of accumulations of dust occasionally.

An Ingenious Oil-level Indicator.—Giving indication of appreciation of the thoughtlessness of motorists in general one prominent manufacturer has taken to equipping his cars with an oil-level indicator which short circuits the ignition current when the supply of lubricant drops below normal. It is nothing more complicated than a tube inclosing a float buoyed up by the oil. The float carries a contact which touches another contact when the float drops, thus short circuiting the magneto and giving unmistakable indication of the scarcity of oil.

Electric "Cyclecars" for Berlin.—For some time authorities of the city of Berlin have been experimenting with a new type of light electrically propelled vehicle for the distribution of mail, and a number of the cars have been purchased. In appearance and construction they are not unlike the new type of small automobile, styled "cyclecar" for the want of a better name, that has sprung into such prominence in England within the past year. They are capable of transporting 500 pounds at a maximum speed of 18 miles an hour, the battery being of sufficient capacity to permit a working radius of approximately 40 miles on a charge.

Worm Drive and "Valveless" Engines Abroad.—Although development of the worm drive is practically at a standstill in England, where it first made its appearance, it is only just being taken up with seriousness by French builders, who in other matters generally have taken to such innovations with avidity and almost without the thorough investigation which invariably precedes British adoption of any new construction. The so-called "valveless" engine—Knight types and others—which also first made its appearance in England, on the other hand, is very much more in vogue on the Continent than it is across the Channel.

Why Not Papier-maché Bodies?—Now that *papier-maché* is used so extensively in other industries there would seem to be opportunity for employing it with profit in the manufacture of automobile bodies. The framework of the body, for instance, might be built up of netting and light steel braces with the *papier-maché* firmly pressed into the interstices of the netting. Such a body would be lighter than a steel body, less expensive to build than an aluminium one, and strong enough. Incidentally, *papier-maché* is capable of being highly finished and it is quite probable that enamel would show less tendency to chip or flake off it than when metal is used.

Revenue from Battery Charging.—With the increasing use of electric vehicles for both pleasure and commercial purposes central stations are paying more attention to battery charging as a prime source of revenue rather than a secondary one, and the wisdom of the practice is revealed by the fact that one electric light company last year earned $150,000 net from this source alone. The previous practice of viewing battery charging as an excellent "side line" to assist in reducing overhead expenses, rapidly is giving way to the more logical view that it may with profit be made a specialty, in charge of qualified experts ready and willing throughout the twenty-four hours instead of during only that time when the central station meters do not indicate the peak load.

Gasoline Up in England.—Echoing recent American advances in the price of gasoline, the British Shell interests, which supply the bulk of the fuel used in England, have announced an advance of approximately 4 cents a gallon in the price of their standard grades, Shell I and Crown, which formerly sold for 39 and 37 cents a gallon, respectively. The new prices are 43 cents a gallon for Shell I and 39 cents for Crown. What is even more important, as indicating a measure to stimulate a demand for the heavier fuels, is the announcement of a new grade of fuel known as Shell II which is priced at 39 cents a gallon. The specific gravity of the new fuel is given as 0.728 to 0.735, as against 0.715 to 0.720 for Shell I and 0.745 to 0.760 for Crown. The Anglo-American Oil Company, which supplies fuel known as Pratt's spirit, also has increased its prices, bringing them on a par with those of the Shell products. Incidentally, it is interesting to note that the present price of gasoline in South Africa is 75 cents a gallon, and this is said seriously to affect the trade in large cars.

End Dump Bodies for Commercial Vehicles

By Ross Babcock, M.E.

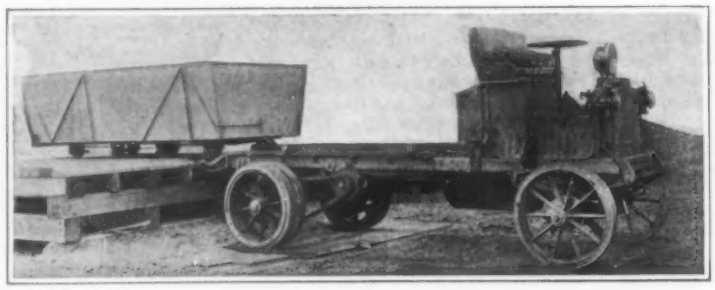
As divided as are opinions on the operative cost of commercial vehicles, engineers are of one mind that truck efficiency demands the reduction of idle time to the minimum. The attainment of maximum efficiency with any piece of machinery requires its operation at as near to full capacity as is possible, and the elimination of work or movement that is not strictly useful; and the motor truck is no exception to the general rule. It costs very nearly as much to operate a truck light as it does to operate it loaded, and where it is not possible with the aid of removable bodies, for instance, to reduce the ratio of time spent in idle running to time spent in performing useful work, other means must be adopted. Otherwise it is altogether likely that the yearly balance will be on the wrong side of the owner's books.

Until comparatively recently little heed of specialized body designs has been taken by commercial vehicle builders, though within the past twelvemonth this feature has come in for its just measure of attention. One reason for the noteworthy change of front on the part of manufacturers very likely is due to a general awakening to the fact that if outputs are to be disposed of, the maker must not only help the purchaser by showing him how to use existing designs with profit to himself, but in addition he must suggest new uses for his products or adapt them to uses heretofore served only by horse-drawn vehicles.

In this respect, it is interesting to note that the end dumping body, either manually or mechanically operated, slowly but surely is assuming the place of importance it undoubtedly deserves. There are abundant reasons why this should be so. Given sand or coal or broken stone to handle, for instance, acute sight is not needed to make plain that antiquated unloading methods—shovels and the muscular power of a "gang"—scarcely are compatible with the modernness expressed by the vehicle itself. Such methods necessitate that virtually all the time saved by the motor truck in making the haul quickly be sacrificed in unloading. Hence, it is entirely logical that some means of making up the deficiency be sought for, and the dumping body truck represents that means. Already there are a score or more of makers who specialize in the construction of such apparatus, and if the present tendency can be taken as a criterion, the ranks of those manufacturers without doubt will be materially swelled in the not far distant future.

There are four general types of dumping bodies, and they are nearly all of the up-ending variety. Side dumping bodies are not much used, probably because it is so much easier to maneuver a motor truck than it is to maneuver a horse-drawn one. Seldom is space so restricted that it is impossible to back the truck into position.

In designing these dumping bodies, the tremendous power of the screw is understood and has been very liberally made use of. Hence, the screw-operated mechanism forms one group by itself. The other three groups may be broadly classified into (2) those that employ some sort of rack and pinion mechanism, (3) those that are chain hoisted, and (4) those that are hydraulically operated.



Figs. 1, 1A and 1B.—Motor truck with dumping and "demountable" body.

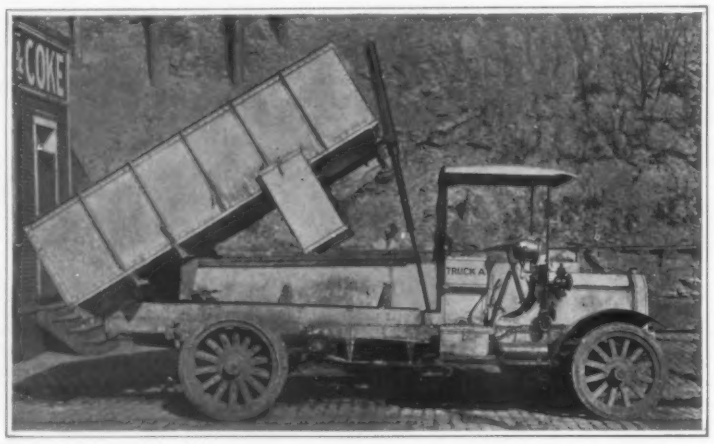
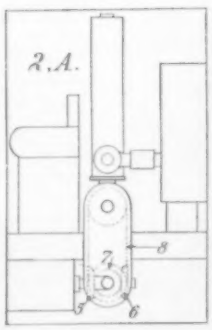
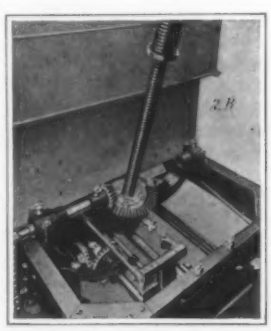
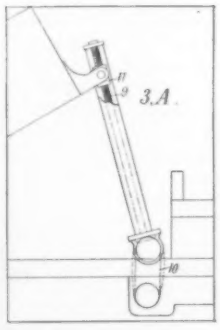


Fig. 2.—Dumping body elevated by a double telescoping screw.







Figs. 2A and 2B.—Telescoping screw details. Fig. 3A.—Plain screw elevator.

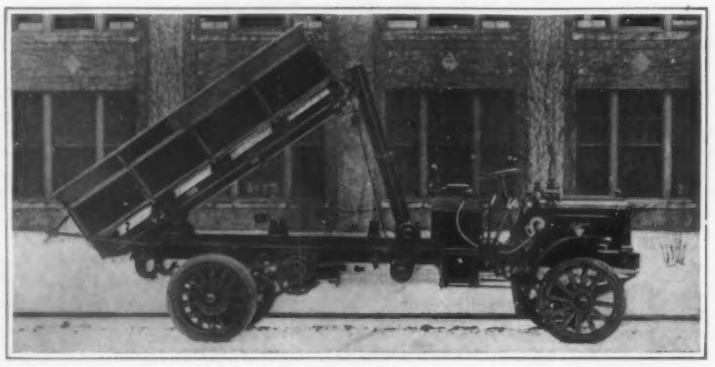


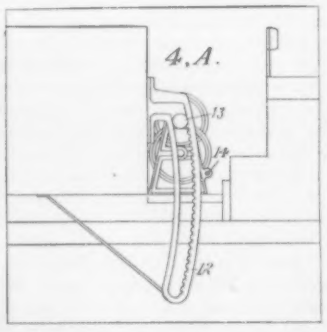
Fig. 3.—Dumping body elevated by a power-driven plain screw.

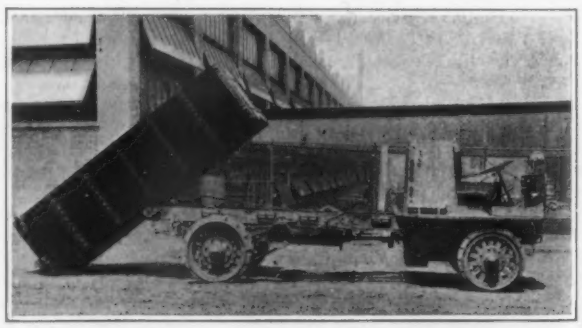
The arrangement shown in Figs. 1, 1A and 1B, is interesting, for it not only provides a means of dumping the body with the power of the engine, but the body is "demountable" as well. For operation, it depends upon a longitudinal screw *1* driven through a pair of gears *4* by the engine. A nut *2* on the screw is hinged to an arm *3* which is permanently attached to the body. The body is mounted on rollers. As it is forced backward by the screw, the first pair of rollers drops into the curved end of the track on the chassis, thus forming a bearing on which the body tilts. When the body is to be dismounted, the truck is backed up to a platform of the proper height and then, instead of dropping into the curved ends of the track, the first pair of rollers passes upon the platform and the body continues straight back until it is clear of the chassis, when the arm *3* is uncoupled from the screw at the nut *2*. To return the body to its normal position, the direction of rotation of the screw is reversed by an idler pinion which is brought into action by means of a lever conveniently placed at the driver's right hand.

In Figs. 2, 2A and 2B an altogether different and more popular arrangement of the screw and nut principle is depicted. In this case the screw is vertically mounted on a swiveling joint and driven from bevel gears and chain from the propeller shaft. The screw itself is virtually a double screw, or one screw telescoping into another. Thus, when the body is down, the height of the screw is only slightly greater than the height of the body. The double screw is operated from a pair of bevel wheels *5* and *6*, mounted on a shaft and arranged so that either may be clutched by means of a lever at the driver's seat. Engagement of the bevel *5* therefore causes the sprocket wheel *7* to turn in one direction, the movement being transmitted to the screw through the intermediary of a chain *8* and another pair of bevels, and thus to hoist the body. Engaging the other bevel *6* causes the chain to run in the opposite direction, thus bringing the body down again. The shaft on which the bevels *5* and *6* are mounted is driven from the propeller shaft through another pair of bevel gears. In operation, the inner screw first rotates within the outer one, raising the body half way, when a stop causes the outer screw to rotate within its casing, raising the body the rest of the way.

The arrangement shown in Figs. 3 and 3A is considerably simpler, though it has the disadvantage that when the body is lowered the screw projects above the body quite a distance. It is thoroughly protected, however, and there can be little objection to it unless the vehicle is to be used where the head-room is very restricted. In this case the elevating screw *9* is driven by a short inclosed chain *10* from a transverse shaft which is driven by a pair of inclosed bevels on the clutch shaft. Engaging either bevel serves to rotate the screw in either direction, thus causing the

(Concluded on page 382.)

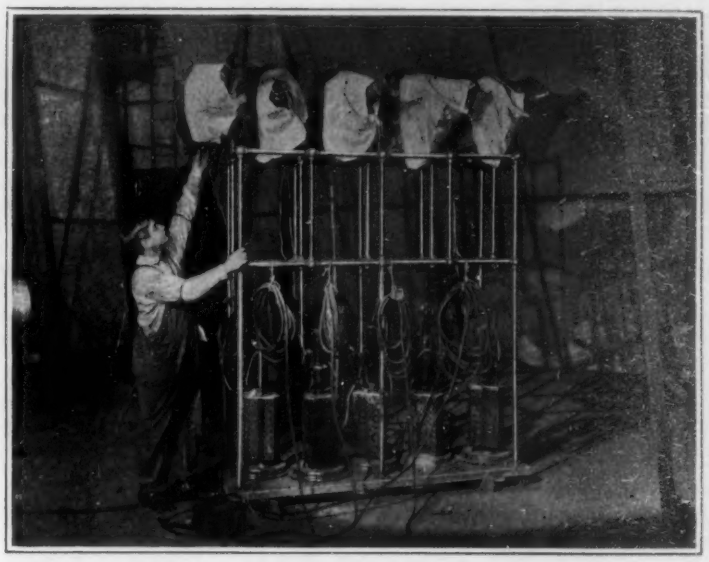




Figs. 4 and 4A.—One of the simplest types; a hand-operated pinion and curved rack. Fig. 5.—Plain rack and pinion and chain for drawing the body back.

END DUMP BODIES FOR COMMERCIAL VEHICLES

Raising up the moon; 3,650 candle-power is required for a full moon.



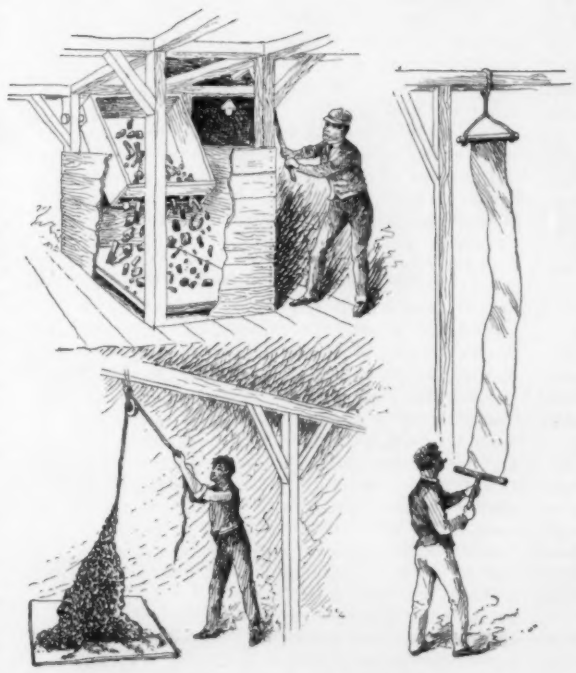
Sciopticons for projecting stars.

The Elements on the Stage

Thunder, Lightning, Wind, Rain and Fire

THE production of thunder, lightning, wind, rain and fire, as well as astronomical phenomena, has long attracted attention of theatrical engineers and electricians. We have been enabled through the courtesy of the officials of the Century Theater, formerly the New Theater, in New York city, to present to our readers a unique series of pictures which are of great interest. In passing it may be stated that the stage of the Century Theater is a most remarkable one, and is especially adapted for spectacular productions, and we hope at a later date to present an article on the stage proper. One of the unique features of it is the great turn-table driven by an electric motor, thus permitting one scene to be set while the audience is viewing another scene. The revolving stage is not needed in plays where drop scenes and cloths are used exclusively. The turn-table was used in the fire scene in "The Daughter of Heaven," a drama of modern China by Pierre Loti and Judith Gautier, which succeeded "The Garden of Allah" at the Century Theater. The big Algerian play with its marvelous scenery and its wonderful sand-storm was even exceeded in beauty by the gorgeous setting of the Chinese play. The scenery, properties, costumes and effects were a revelation of refined Oriental taste.

We need not concern ourselves with the play proper, except for the fire scene, which occurs in the second part of the play. The Manchu advance has swept everything before it. Of all the Ming strongholds, the palace citadel alone holds out. Gaping breaches have been torn in its walls by the enemy's artillery, but the soldiers of the Empress go on fighting with unfailing courage. The Empress is anxious to die with her faithful followers, but is dissuaded from doing so by the hope that if she is able to escape by the secret passage through the tombs of her ancestors, she may yet live to see the sovereignty of her son established. Before she goes, at the request of her soldiers, she lights the great funeral pyre she has built in order that they may meet death at their own hands rather than fall into those of the enemy. The fire becomes brighter and brighter, while the defeated warriors throw themselves on the blazing logs. The fire streams up and is lost behind the top of the proscenium arch. The manner in which this effect is produced is very interesting, involving as it does an interlocking series of effects which result in a most realistic effect without real fire.



The three stages of thunder.

The funeral pyre measures 8 by 10 feet, and is 6½ feet high. It is dragged on a truck to the back of the turn-table before the curtain is scheduled to rise on the "Walls of Nankin" scene. It is located over a trap, so that when the turn-table is revolved the pyre is brought directly over an opening in the lower portion of the stage flooring. The pyre is made of an iron frame covered with wire netting and covered with asbestos cement. The opening in the floor of the stage serves to carry the hose for the smoke and steam and for the artificial light used in carrying out the idea. The funeral pyre is also covered with silken materials, such as artificial feathers. In addition to these fringes there are two or more mats which are so

Thunder drum for rain and reverberating thunder, lightning flasher and wind machine.

Incantation scene. Air is forced through acid, ammonia and perfumed glycerine.

placed that the light projected upwardly through the opening falls upon them. These mats are mounted on movable boards and are designed to be raised within the structure by ropes which are pulled up slowly by men at the back of the pyre. By having the mats adjustable vertically, it is possible to represent the fire starting and increasing in volume until the flames apparently arise to a considerable height above the structure, and such increase in height and size may be made by jerky strokes on the handle so as to cause the flame to apparently rise to its height at intervals.

The smoke and the wind necessary to assist in the production of the illusion are generated in the cellar below, as shown in our engraving. Two men are concealed in the pyre, and with flexible canvas pipes they diffuse the smoke and set the silken material in commotion so as to give the swirling effect of flame. This wind is derived from a blower driven by electricity. When the Empress applies the torch the flames rise and are lighted one at a time with arc lamps, giving the effect of the fire rising higher and higher. The electric spot-lights are unblinded when the blower is started. A powerful search-light is used for lighting up the big flame. The smoke is generated in four metal smoke boxes containing forty-eight one-minute smoke pots, which are lighted by tapers and kept damp with water which is squirted during the progress of the effect through small iron doors in the smoke boxes. As this smoke passes upward through the pipes, it passes through four wire gauzes which positively prevent any sparks being scattered around the stage. At the back of the pyre is a steam jet arranged so that the steam rises at the back of the pyre, carrying the reflection of the light from the search-light to the flies, giving it the appearance of a very high flame. Electric fans are also used underneath the stage out of the path of the beams of light projected from the several electric lamps. The effect of sparks is given by confetti, which is thrown into the blower and is projected upward by means of the canvas pipes. The effect is so realistic that the fire can continue, if desired, with all the stage lights on. It requires sixteen men to work this illusion. The manipulation of the spot-lights and the search-light is very clever, and the effect from the audience is that of a true conflagration. The men inside of the pyre are dressed in asbestos clothing. Some idea of the cost of production of an effect which only lasts for a very short time may be gained when it is stated that $4 worth of smoke pots are used every performance.

The production of wind effect, thunder and lightning are usually worked practically simultaneously, and three of these devices are shown in one of our engravings. The wind machine can be constructed by any carpenter. It consists of a drum with slats which are rotated over an apron of corded silk, which produces the peculiar whistling sound of wind. Usually two wind machines are used—one on each side—in the side scenes or behind the back drop.

The lightning device is shown in the center of the engraving. A metal hood provided with a wire gauze screen to prevent fire serves to hold five cups of powdered magnesium. A fuse is placed in each cup, which is connected independently to a portable switch box, so that one of the electricians can turn on the current, exploding one or more of the charges, so as to give the required effect.

Thunder is produced in two parts of the stage. The crash takes place in one of the fly galleries, while the reverberation or roll is produced on the thunder drum, which is beaten by hand near the back drop. The cue is given to the fly man by means of an electric light. When he receives the signal he releases a bolt which allows a pivoted box to dump about 800 pounds of stone and assorted junk down a chute, striking a large iron plate at the bottom. This is immediately followed by 300 pounds of chain, which are also released and fall on an iron plate. Then the roll is begun by dropping five or six cannon balls down a chute which is tortuously inclined and is technically known as a "rabbit hutch." The *finale* of the effect is produced by deforming a large sheet of sheet iron which is twisted. This is used in connection with the thunder drum. The simultaneous production of wind storm, lightning and thunder calls for simultaneous signals which must be obeyed in the shortest space of time.

Another play at the Century Theater which has had a considerable run is "Joseph and His Brethren," a pageant play in four acts, based on the biblical narrative. Several of the scenes are of great beauty, particularly that which takes place at the Pyramids in the fourth act, where the moon and star effect is most beautiful. Both of these effects as well as the fire scene were invented by the electrician of the theater, Mr. Benjamin Bierwald. The moon is a large basin-like affair, which is capable of being raised and lowered with a small winch. The linen disk is painted as we see in astronomical photographs. Behind the disk are incandescent lamps totaling 3,650 candle-power. As the moon rises the lights are put on resistance and just show a glow as the disk is raised. The resistance is then lessened and the lamps become fully incandescent. A board in front protects the linen disk when it is lowered. The time required to raise the moon is seven minutes for fifteen inches of vertical travel. The effect of the moon rising above one of the pyramids is most realistic.

The stars are produced by projecting lanterns on sciopticons. In "The Garden of Allah" there were twenty-one of these projecting lanterns in use in different parts of the house. In "Joseph and His Brethren" eight lanterns are used. For very brilliant stars long focus lenses are used six feet from the drop. The stars are made by punching holes in a blackened brass plate and are projected on a curved cyclorama, which is let down while the scene is being set. The lanterns are covered with an asbestos cloth to prevent light leakage.

One other effect which is illustrated remains to be described. The incantation scene which occurs in the second act of "Joseph and His Brethren" is very interesting. In the room of Zuleika is a statue of Astarte, goddess of magic. In order to show how the effect is produced, the statue of the goddess, known vulgarly on the stage as the "cook," has been temporarily removed to the proximity of the back drop, which is cut away so as to show the method of manipulating the smoke. Zuleika brews a love philter in a caldron before the goddess Astarte. Smoke arises from the bottom of the caldron, tinged with various colors. She pours the potation into a gold cup which is given to Joseph in the same scene. The trick is performed as follows: Compressed air is contained in an ordinary iron tank such as is used in lantern projecting. Air is driven through bottles containing hydrochloric acid and ammonia. The smoke is then washed and driven through perfumed glycerine, when it is ready to be liberated. A man kneeling down is working the dimmer, changing the light from red to green. The man by him is watching for cues to let the smoke rise, as the illusion would be promptly dissipated if the changing of the colors and manipulation of the volume of smoke were not perfect. Thus the smoke must cease instantly after her incantation has been finished.

Such in brief are a few of the interesting ways by which scenic effects are obtained to the delight and mystification of the onlookers. We are indebted both to Mr. Bierwald and Mr. W. W. Aulick for courtesies in connection with the preparation of the present article.

Misnamed Grains and Fruits

THE Chief of the Division of Horticulture in the Philippines, Mr. O. W. Barrett, has undertaken the heroic task of getting the inhabitants of those islands started right in the matter of popular plant nomenclature. As the Philippines are on the eve of becoming an English-speaking country, he thinks it is opportune to apply the doctrine that an ounce of prevention is worth a pound of cure, and, before it is too late, he wishes to prevent the people of our new possessions from falling into certain anomalies of language that have become almost universal in the United States.

There is, of course, no more striking example of the way in which American speech has diverged from the parent tongue than in our use of the word "corn." In British countries there are several kinds of "corn," including wheat, rye, barley, oats, maize, rice, and even leguminous plants, as peas and beans. Locally the word is often understood to mean the leading cereal crop of the district; hence while "corn" means wheat in most of England, it means oats in Scotland and Ireland. Our English ancestors found maize under cultivation by the Indians all over this country as their principal food crop, and gave it the not inappropriate name of "Indian corn." The name "mahiz" (whence "maize") was current in Haiti, where the plant was first seen by Columbus.

The fact that the Spanish name for this plant, "maíz," is already familiar to the Filipinos would, no doubt, facilitate the adoption of the name "maize" in preference to "corn" among the islanders who learn English. Such is Mr. Barrett's hope; and he says, in writing on this subject in the *Philippine Agricultural Review*, "Let us adhere firmly to the old (pre-Columbian Arawak 'mahiz') correct name by which this plant is known practically everywhere outside of the United States." However, there are certain difficulties in the way of carrying out this reform in a land where the natives are learning English from Americans, identical with those which would be encountered if the same thing were attempted in this country. Mr. Barrett does not appear to realize that the word "corn," as used by Americans, has so ramified in phrases and compounds of everyday use that to abandon it would entail an appalling number of other changes in our speech. Thus, to be consistent, we should have to substitute "maizemeal" for "cornmeal," "maizebread" for "cornbread," "maizestarch" for "cornstarch," and so on. No longer would Young America delight in the pink and the white varieties of "popcorn," but in "popmaize"! And how on earth should we ever persuade the newspaper paragrapher to banish "Farmer Corntossel" for so unconvincing a personage as "Farmer Maizetossel?" Let Mr. Barrett light his pipe ("maizecob," if he will have it so), and reflect upon the uttermost consequences of his rash suggestion.

The rest of his propaganda is less revolutionary. For example, in urging the spelling "coconut" in lieu of the old-fashioned (but not oldest-fashioned) "cocoanut," he is merely seconding the recommendations of most American lexicographers. "Cocoa" for "coco," in this sense, arose from a stupid blunder in Doctor Johnson's dictionary, and has never had the sanction of careful writers.

A certain fruit which Mr. Barrett thinks should not be called "alligator pear" has become tolerably familiar in recent years to Americans who can afford exotic delicacies. Of course, it is not remotely related to the true pear, and some varieties are not even pear-shaped. In advocating the more euphonious name "avocado," Mr. Barrett says: "Objection to this word is gradually dying down, but, for some unknown reason, there still lingers in the minds of thousands of people an apparent preference for the hideous name 'alligator pear;' this is probably due, however, to the plebeian shrinking from any foreign-sounding word, especially if it has more than three syllables."

Another tropical product which has attained prominence in this country in comparatively recent times, and which has reached a greater perfection in Florida and California than anywhere else in the world, is probably best known to most of us as "grapefruit." This name is said to be due to its grape-like flavor (which few people can detect), or to the clustering habit of the growing fruit. It is sometimes called "shaddock," a name that properly belongs to a more primitive and much coarser variety of the same species. Mr. Barrett would have us abandon "grapefruit" in favor of "pomelo."

The "Sanatogen" Price Fixing Case

HEARING has recently been had before the United States Supreme Court in the case of Bauer & Co. and the Bauer Chemical Company against James O'Donnell, a Washington druggist. The plaintiff-appellants are manufacturers of "Sanatogen." The case comes before the court by certification from the Court of Appeals of the District of Columbia and the question involved is stated in the appellant's brief to be as follows:

"Can a retailer sell a patented article having a license notice thereon restricting the price at which the article can be sold to the consumer, such sale being made at a lower price than the license price, without such sale constituting an infringement of a patentee's rights when the article is made by the patentee, but is purchased by the retailer from a jobber?"

It is contended by the appellants that their patent grants them the right to exclude all others from any making, using or selling of the patented invention and relies on the decision in the Dick case, while the counsel for O'Donnell rely on the case of Bobbs-Merrill v. Strauss and on distinctions they claim to exist between the Dick case and the present one.

The case is of immense importance, because for the first time the United States Supreme Court will have to pass upon the right of a patentee to fix the price on a patented article.

The Current Supplement

THE light of the sun streams down upon us year after year, a valuable source of energy for the most part going to waste. It is highly probable that the chemist is destined in the future to tap this stream for the benefit of mankind.—The Photo-chemistry of the Future is the subject of Prof. G. Ciamician before the International Congress of Applied Chemistry, published in this week's issue of our SUPPLEMENT.—Prof. W. Stempell tells us how the size of minute structures in microscopic organisms may be estimated.—Christian Dantsizen gives an account of the research laboratory of one of our great firms of makers of electrical apparatus.—G. B. Cortelyou speaks on "Commercial and Financial Aspects of the Gas Industry."—The Paris Correspondent of the SCIENTIFIC AMERICAN describes a new method of studying stream lines in air currents in the neighborhood of obstacles.—P. S. Helmick describes some experiments on the conduction of electricity through an insulation.—The manufacture of airship envelope fabrics, and the requirements which they must fulfill are dealt with in an article reproduced from the *Engineering Supplement* of the *London Times*.—J. A. Secor writes on the waning supply of gasoline.—A richly illustrated article introduces to our readers the latest and largest liner of the Anglo-American fleet, the "Aquitania," launched on April 21st, 1913.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Wright Decision

To the Editor of the SCIENTIFIC AMERICAN:

In reading the account in your journal of March 22nd of the decision in the Wright aeroplane case, I do not find that you refer to the Gottfried Schroder German patent, No. 77,036, of October 4th, 1894. This Schroder patent involved a wedge-shaped balloon pointed at its fr nt end and having a flat underside, and the balloon contained sufficient gas so that the whole airship with its contents would be supported by the gas. The airship was propelled forward by means of paddles operating like the screw propeller of a ship and driven by an engine. Transverse equilibrium is maintained by side wings pivoted and inclined simultaneously in opposite directions by crank and link connections, and an upright universal rudder is pivoted and connected with a steering handle in such manner that the rudder moved in exact correspondence with the handle when in any direction. This patent appears to show ailerons at opposite sides of the plane underface of the balloon in connection with an upright rudder. While you do not in your article, above referred to, mention this Schroder patent, it is discussed in an appendix to the brief of Mr. H. A. Toulmin, solicitor and counsel for the complainant in the case of the Wright Company v. Herring-Curtiss Company and Glenn H. Curtiss, in which appendix it is said, referring to the German patent, "it is only for a balloon machine. . . . Judge Hand disposed of similar balloon proposals in the Paulhan case, saying 'these are all for lateral planes to dirigible balloons. The whole problem is so entirely different when suspension is effected by a reservoir containing a lighter gas than air, that there is not the least resemblance between the patents and the patent in suit.'" It is thought, however, that the Schroder patent will always be interesting in the history of aero navigation as an early instance of stabilizing device.

ONE INTERESTED.

[While the Schroder patent undoubtedly does disclose equilibrating surfaces, which may be regarded as ailerons, it does not follow that the patentee was aware of the necessity of operating the vertical rudder simultaneously with the ailerons to prevent spinning of the entire machine. The Wright brothers were the first to insist on that principle; without it dynamic flight is impossible. —EDITOR.]

The Highest Type of Spring Wheel

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the letter of G. F. Fisher in your issue of March 22nd, it is evident that Mr. Fisher is not familiar with the "highest type of spring wheel," since he states that the springs at the bottom of the wheel must necessarily be flexed in an opposite direction to those at the top of the wheel. His statement is true of most spring wheels, but there are wheels wherein the springs are all flexed in the same direction, whether at the top, bottom, side or any point in the wheel. This flexure is not necessarily slight, depending entirely upon the strength of the springs used, and in all cases there is absolutely no flexure of the springs during the revolution of the wheel except that caused by an irregularity in the roadway. There may be an initial resilience of one half inch for example, that is, a deflection of one half inch in the wheel from the weight of the machine, and yet there is no flexure of the springs in any direction during the revolution of the wheel in the movement of the car, except as before stated as is caused by irregularity in the roadway.

A wheel so designed with an extreme movement or resilience of one and one half inches and deflecting one half inch under the weight of the car may be weighted down by loading the machine to any point of deflection from one half inch to one and one half inches and at no point will flexure of the springs occur during the movement of the car over an even roadway.

This result is obtained by attaching the springs from one part of the wheel to the other at points found in a line parallel to the axis of the wheel—virtually a neutral point; thus a given movement in any direction from the neutral point must cause the same eccentricity of the points and the same flexure of the springs.

It should not be difficult for Mr. Fisher to obtain details of a wheel of this description.

New York city. HARRY E. SIPE.

Compressed Air as a Protection for Battleships

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to make some statements in connection with an article in SCIENTIFIC AMERICAN of March 22nd, 1913, on "Compressed Air as a Protection for Battleships." It is stated in this article that "the serious consequences of a stumble on a submarine mine . . . . led our naval authorities to undertake a novel experiment more than a year ago." It is further stated that the test equipment on the armored cruiser "North Carolina" proved so successful that our battleships, including the "Pennsylvania," shall be equipped in the same way.

When, during the Russo-Japanese war, two Japanese battleships were sunk by mines, I sent, in April, 1904, to the Japanese minister in Washington, and later direct to the Japanese naval *attaché*, several letters for transmittance to the Japanese Navy Department, suggesting that they make their ships unsinkable by forcing entering water out by gas pressure. At first I suggested only self-inflating (by calcium carbide) balloons, later compressed air for inflating the balloons, and compressed air alone, without balloons. In a letter of April 20th, 1904, I stated that I intended not to divulge the idea until told that the Navy Department did not want it, in which case I intended to use it commercially or otherwise. The letters were acknowledged, and it was stated that they had been transmitted to the proper place. I never received a communication from the Japanese Navy Department; at least none referring to this matter. (A small contribution for the wounded was acknowledged by the paymaster of the navy.)

Three years later we had the "Japanese war scare." At a certain time so much was said about the probability of Japan going to war with the United States, that I considered it my duty as a citizen to write to our Navy Department and state that during the Russo-Japanese war I had made some suggestions to the Japanese Navy Department, one of which was to make ships unsinkable by gas pressure, using either inflating balloons or compressed air alone, asking whether they wanted to know the other suggestions.

The Navy Department answered: "Washington, July 26th, 1907. Replying to your letter of the 13th inst., suggesting the use of gas to force water from compartments of vessels: You are informed that the Board on Construction, to which your letter was referred, reports that the ideas suggested by you are not novel, and are made use of in some cases in connection with wrecking operations. However, the Board is of opinion that the ideas suggested are not practicable nor desirable for naval purposes." OTTO MEYER, Ph.D.

Richmond, Va.

The Value of Inventions

To the Editor of the SCIENTIFIC AMERICAN:

The word *invention* literally means anything contrived for any purpose that has not been used or known to the prior arts. In a practical way inventions are understood to mean something designed to save time, labor, make money, and add to the advancement of civilization. Without inventions progress would soon cease and our vast continent would go back to the wilds.

If we were to take out everything in the United States that is founded on inventions, there would be little left. If George Stephenson or someone else had not invented the steam locomotive, the railroad systems of the world would never have had their existence. Had Robert Fulton not invented means of propelling ships by steam, the ocean transportation companies would not be carrying millions of tons of valuable merchandise from seaport to seaport. If McCormick had not seen the possibilities of the self-binder, we would still be harvesting grain by hand. After the cook stove, cotton gin, steam engine and a few other less important machines had been placed in working order, the greater number of the American people thought the climax had been reached, and there could be few more improvements made.

Edison, Westinghouse, DeLaval, Marconi, Boroughs, and Knight did not look at things this way. These great inventors believed that the field of invention and science was as great in their day as it was in Fulton's. So having this belief and an iron-bound determination, these men began working on things that the supposed to be wisest men of the day thought was an impossibility to accomplish mechanically, yet they could not be influenced to give up the job, and after many years of unremitting toil and study these great benefactors perfected the seemingly impossible, which has added billions in wealth to our nation, and amply repaid them for their time and trouble.

Thousands of others have responded to this most noble and useful calling, which has kept the wheels of industry turning and the magnitude of commerce expanding from year to year. Not all inventions are profitable to our country or pay the inventor vast sums of money. Thousands of people fail in this line because their machines and devices are not practical, or else they have not sufficient means and courage to promote them.

Knowledge having no bounds, I believe the opportunities for the young American in this field are as great to-day as they were fifty years ago.

If we expect to maintain a steady advancement in progress, it is necessary to apply the knowledge we have gained by the experience of others to our designs in striving for still greater things. Having given this work several years of my time, I find the greatest requisite for success is self-confidence coupled with patience and thoroughness, for we all make mistakes. The greatest geniuses have made more mistakes than perfections, but as one success is worth more than many failures cost, it is well worth our time to use every influence in order to make the most out of the talent with which we are endowed.

For this country to continue in advancement, the Government must adopt measures that will thoroughly protect the inventors to the greatest possible extent.

Tunnel Hill, Ga. SAMUEL H. KENNEDY.

The Spring Wheel Problem

To the Editor of the SCIENTIFIC AMERICAN:

Referring to a letter from Mr. M. K. Domis in your issue of March 1st, please to allow me to state that in my humble opinion both Mr. G. F. Fisher and himself are badly off the track in their ideas as to spring wheels. In my opinion, a spring wheel is essentially and primarily a substitute for the pneumatic tire, the persistence of which latter, in the face of its enormous disadvantages, is sufficient proof of the fact that as yet the spring wheel is but a dream. Evidently Mr. G. F. Fisher had in mind a type of spring wheel very common in the Patent Office records, where a rigid ring is placed outside the rim and the intervening space filled with springs of some form such that they exert most of their force when the ring is displaced, along the line of displacement in compression on one side and tension on the opposite. Such a wheel would be one in which spiral springs were arranged radially. On the other hand, Mr. Domis has in mind only that form in which the springs are of such form as to offer equal resistance in all directions in the plane of the wheel, combined with the above-mentioned rigid outer ring. Such a wheel is one in which the wheel is a disk with say six holes in it parallel to the axis, and a large hole to clear the hub. The six holes each contain pins fastened into disks on the hub, forming a wheel which can thus be moved in any direction an amount determined by the looseness of the six pins in the six holes. Surrounding these pins are springs of various forms which are similarly affected, no matter in what direction the movement may be. They may, for instance, have the form of spirals like clock springs. Both these gentlemen seem blind to any other form of spring wheel, whereas the ideal, e. g., the one which most nearly approaches the pneumatic tire, and the only one which can ever substitute for it, *must* have a flexible and not a rigid rim. I was astounded lately in going over a pile of spring wheel patents to find one after another with the same old story of the rigid outer tire capable of slight movement against a spring of some peculiar form, whereby the inventor thought he could produce a substitute for air. In my mind the ideal spring wheel will be one in which the springs are so arranged that a small portion of the rim may be dented in and only the springs directly under the "dent" be affected. This wheel can strike a stone and pass over it with very little shock, since only one or two of the springs will receive the pressure, which cannot raise the wheel from its course simply because only one or two springs are not strong enough to sustain the weight, as the wheel will be so constructed that when resting on a flat surface, a large number (say ten) of the spring segments of which it is constructed will actually be in contact with the ground and sustain the weight. This is just the way the pneumatic tire behaves when on the road. The fallacy of the other arrangement can be shown to anyone who wishes to try the experiment, by placing a solid iron ring over a pneumatic tire and using it. It is as rough as a steel tire when so treated. Yet there is the most resilient form of spring known placed in a wheel. No form of spring, when placed inside a solid rim wheel, can answer as well as that much added resiliency in the vehicle springs themselves, except that they may save the axles to a slight extent. I gravely doubt whether the added weight placed properly in the axles to add strength, and in the springs to add resiliency, would not give much better results. In my opinion the spring wheel is not a thing which will be marketed in a small way or remain under a bushel. When it comes, the present demand, created by the entirely unsatisfactory pneumatic tire, will be too strong to allow it to stay undeveloped. But it has got to be good. It must be not a spring wheel at all, but a resilient spring flexible tire. Suppose the springs do not last? We now pay from $100 to $275 for four rubber affairs, which after three thousand miles of use sell for $1.00 to $2.75. As for me I would be willing to wear out a set of stamped steel springs even every one thousand miles instead of this *if I could ride as comfortably on them.* When the ideal "spring wheel" arrives, I will.

Meanwhile many a man can save himself the price of a useless patent if he will try the experiment and apply the reasoning above, and not think air can be simulated by a rigid ring resting on some "lucky twist" called a "resilient spring member."

City Point, Va. E. PAUL DU PONT.

Russia's Submarine Cruiser

More Than Six Times the Tonnage of the Next Largest Submersible

By R. G. Skerrett

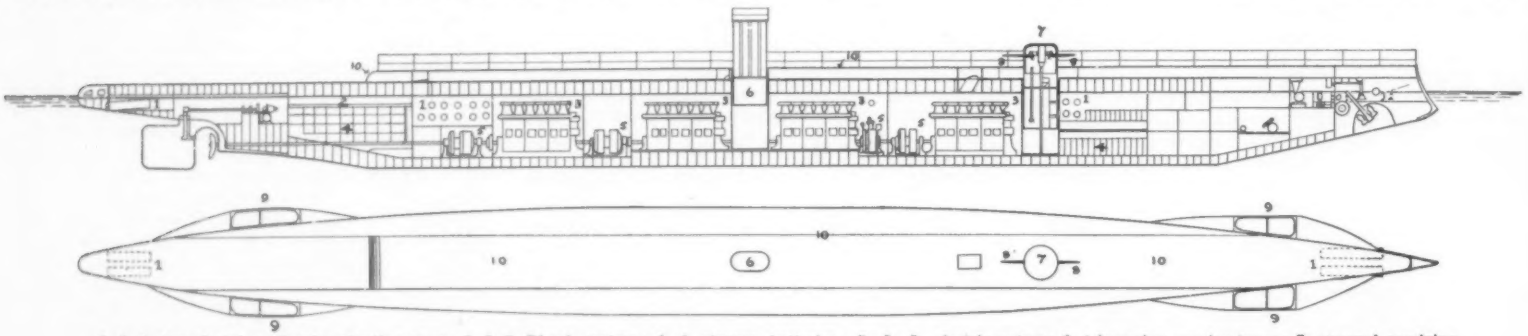
THE Russian government is determined to restore its fleet to the position it enjoyed prior to the war with Japan, and to that end generous provision has been made for its rehabilitation.

More than once Russia has startled the engineering world by her courageous initiative, and again we see this spirit in the submarine cruiser which it is announced the Russian Admiralty will construct. The reader will naturally ask, What is a submarine cruiser? We can answer this best by making a comparison, or, better, a contrast. The biggest submarine yet built for the United States Navy is a vessel of something just short of 500 tons displacement submerged, and the craft proposed for the Czar's navy is to have a submerged displacement more than ten times as great, i. e., 5,400 tons.

Quite six years ago, Mr. Simon Lake planned and offered to the Russian government a mine-planting submarine torpedo-boat of large displacement, but the cessation of the war between Russia and Japan called a halt upon the project. Nevertheless, that design of American origin may properly be said to have influenced the Russian engineer, Schuravieff, in this later development of a kindred type, but beyond that the two vessels are widely dissimilar.

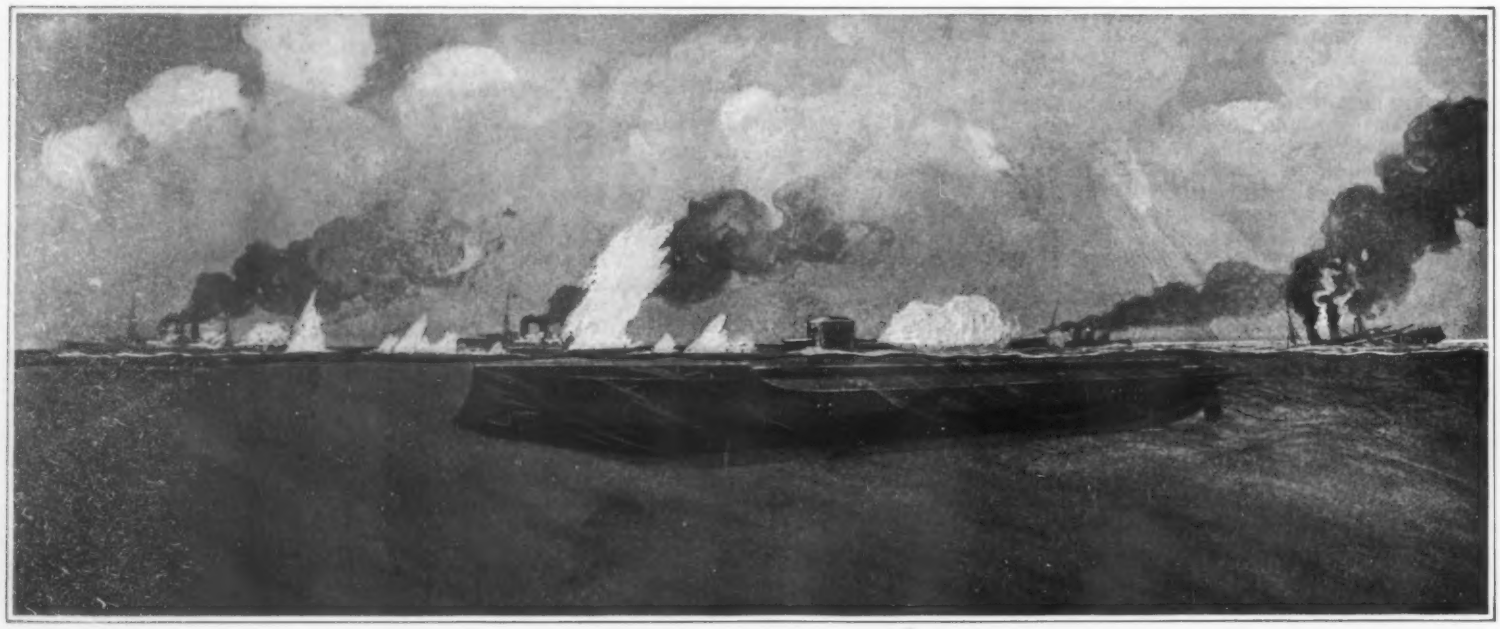
The submarine cruiser is to be virtually an under-water torpedo dreadnought, and she is also to be capable of planting mines while operating submerged. The torpedo equipment will consist of 36 launching tubes with a supply of 60 long 18-inch Whitehead torpedoes. There will be 16 tubes on each broadside, with two bow and two stern launching apparatus. The mine-planting equipment will provide for the carriage of 120 naval defense mines. The vessel will have a battery of five 4.7-inch rapid-fire guns for the purpose of resisting the attack of surface torpedo vessels. These guns will probably prove useful in defending the submarine cruiser during the interval when she is passing from surface trim to a condition of readiness for submerged operations. As a further protection during this period, the inclined and flat portions of the superstructure, together with the revolving turret forward, will be sheltered by armor varying from two to three inches thick. In the light surface condition, the cruiser is to have a displacement of 4,500 tons. This means that about 1,000 tons of water ballast must be handled and taken into the boat in order to get her ready for under-water work. The designer estimates that the vessel can perform this operation in three minutes, but this sounds too conservative in the light of experience with submarines of one tenth the displacement: it will probably take a good deal longer, and the armor and the rapid-fire guns will be very helpful while passing from the surface to the under-water condition.

The biggest of the sea-going torpedo-boat destroyers to-day average about 1,000 tons, and these vessels have from three to four above-water launching tubes. These hornets of the sea make speeds of from 28 to 32 knots, and are absolutely defenseless against an enemy's rapid-fire guns. Here we have a boat of from 4,500 to 5,400 tons displacement, extensively armored, and capable of firing a whole broadside of torpedoes from their sheltered positions below the waterline. But this is not all. A 4,500-ton ship is far easier to drive and to maintain at a speed more nearly her maximum than a lightly-built surface craft of less than one fourth this displacement. Therefore, the submarine cruiser, ton for ton, will be a far more dangerous antagonist than a similar total displacement divided among four sea-going ordinary destroyers. Apart from this, the Russian vessel could conceal herself if she chose, and this the surface torpedo boat cannot do.



1, 1, 1, torpedo tubes; 2, mine-planting room; 3, 3, 3, Diesel motors; 4, 4, storage batteries; 5, 5, 5, electric motors; 6, telescoping conning-tower; 7, armored revolving turret (housing); 8, rapid-fire guns; 9, submerging rudders; 10, armored superstructure.

Inboard profile and plan of Russian submarine cruiser.



A Russian submarine cruiser of 5,400 tons displacement.

We can get a better idea of the general character of this Russian craft from the following schedule of her principal dimensions:

Length between perpendiculars		400	feet
Beam, maximum		34	"
Draught, surface trim		21.5	"
Draught, maximum submerged, to top of turret		29.5	"
Engines, explosive, for surface		18,000	I. H. P.
Electric motors, submerged propulsion		4,400	"
Speed, maximum, surface		26	knots
Speed, maximum, submerged		14	"
Radius of action, surface	at 11 knots	18,500	miles
	at 21 knots	1,250	"
	at 25 knots	730	"
Radius of action, submerged	at 6 knots	275	"
	at 8 knots	154	"
	at 10 knots	80	"
	at 12 knots	42	"
	at 14 knots	21	"

A vessel capable of attaining the foregoing speeds and radii of action above and below water should certainly prove a very formidable adjunct to the coast defenses of any country, and it is plain to see that the relatively sheltered waters of the Baltic would provide an ideal field for the operations of a craft of this nature. A submersible cruiser of the present dimensions would be able to weather any gale and to hold the sea for a long period. In fact, the ship is designed to carry more than 300 tons of liquid fuel and be able to run from the Baltic around to Russia's naval base upon the Asiatic shores of the North Pacific.

Two unusual features of the submarine cruiser are the armored revolving turret forward and the conning tower amidships, both of which telescope and can be housed within the contour of the protected superstructure. The questionable feature of the design is the employment of storage batteries for submerged propulsion.

The naval defense or contact mines, 120 in number, are to be carried in one of the after compartments, where they can not only be assembled, but launched through hatches leading outboard through the bottom. The mines can be planted while the boat is submerged. The Russians know all too well the destructive power of this form of under-water attack, and a submarine vessel provides an ideal medium for sowing a field secretly. The moderate depths of the Baltic lend themselves easily to this form of subaquatic defense.

The largest submarines or submersibles now under construction abroad are in the neighborhood of 800 tons submerged, and the naval world will await with interest the building and the performances of this Russian cruiser. Every material increase in the size of a submarine adds seriously to the problem of getting her rapidly submerged and then controlling her.

New York State Barge Canal

Completing One of the World's Greatest Engineering Works

By Noble E. Whitford, Resident Engineer

ONE of the chief characteristics of the early years of the twentieth century is the rapid and almost universal substitution of the machine—the product of man's brain—to do the work formerly accomplished by his hands.

This statement is no new enunciation, but the repetition of a recognized fact, cited here because the subject of this article illustrates its truth so strikingly.

New York State is engaged in enlarging and modernizing its canals—a system of waterways that were begun nearly a hundred years ago, when much of the territory they traversed was still the primeval forest. Thus the old and the new stand in such close proximity and the contrast between the two canals is so marked—in circumstance and method of building, in the finished product and in the result attained—that a comparison shows the strides of a century's progress.

Times and conditions have greatly changed since a day, now ninety years past, when the arrival of a boat in New York city from the head of Senèca Lake was deemed of such importance that its owners, two farmers of Tompkins County, were given a public entertainment by citizens of New York and were presented with a memorial cup. This was the first boat of any size to come from so far in the interior, and she had sailed much of her course over a canal then building, which was the marvel of its day. Conditions of the time are reflected in the fact that the timbers and cargo of this boat came from the forest and fields near where she was built; her owners were her architects, builders and navigators; her crew was composed of the men who had cultivated her cargo, and even her sails and rigging were manufactured by her owners, the materials for them having been grown on their farms.

When, two years later, the whole of this new waterway was completed, the Governor of the State led a triumphal voyage that extended across the whole length of the commonwealth and lasted for ten days, ending with a pageant in New York city, the like of which had never before been seen on this side of the Atlantic.

For a half dozen years and more, New York State has been engaged in another great canal project—one of the greatest engineering feats of the time—but there has been so little ostentation in prosecuting the work, and its building has been so overshadowed by the contemporaneous construction by the United States of a more spectacular canal, that perhaps it is not strange that so few people, even among our own citizens, appreciate the magnitude and importance of the enterprise which is being rapidly pushed toward completion.

When it is known that the amount of work required in building the barge canal (such as yardage of excavation and concrete and the like) is about three quarters of that at Panama, while its length is more than ten times that of the Isthmian waterway, there comes an appreciation of New York's undertaking. It is significant, moreover, that the barge canal, including the construction of terminals at more than fifty cities and villages, is being built for about one third the cost of the Panama canal.

The near approach of the final completion is told in certain statements contained in the annual report which the State engineer has recently transmitted to the legislature. He says that the failure of contractors on the Champlain canal has delayed the anticipated completion of that branch in 1913, and that the best to be expected is that it will be finished in 1914. He anticipates that the Oswego canal and the portion of the Erie canal lying east of the Oswego junction will also be completed in 1914, thus opening navigation from Lake Ontario to the ocean. He says that probably by 1915 the western section of the Erie and the whole of the Cayuga and Seneca canal will be finished, thereby completing the entire barge canal system.

On January 1st, 1913, the value of work that had been put under contract amounted to $77,324,644. Of the whole project only about four per cent, in length of the canal, remains to be awarded. The total value of work performed to the same date was $53,999,587, or 70 per cent of that under contract. If we consider all contemplated work as under contract, then this amount already done would be a little more than 60 per cent of the whole project.

At several places portions of the new canal have already been in operation for some time. Where conditions permit, traffic is turned into the new channel as soon as it is completed. One lock has been in commission for three years, although full operating machinery has but recently been installed. Of the finished sections, the locks probably furnish as interesting features as any. Some half dozen of these had received their electrical equipment last spring, and some of them were so located that traffic was turned through them. At Whitehall, at the head of Lake Champlain, one might have seen a good example of a new lock, for this structure was in full operation during the season, passing boats of the old canal dimensions, usually in groups of six, since they were towed up the lake in fleets of a dozen or more.

A visit to this lock furnishes a most striking demonstration of the superiority of the barge canal over the old waterway, for the locks that are now passing are but little changed from those used in the original canal a hundred years ago. Entering the power house at the foot of the new lock, we find an electrical equipment, in duplicate, complete and of the latest approved design in every particular. It is necessary to keep this machinery running only during actual lock operations, since, within 50 seconds after water has been turned into the turbines, lights in controller cabinets on the coping indicate that the current is on the line in readiness to begin a lockage at full speed.

Probably nowhere along the line of the canal will the march of progress be seen more distinctly and the contrast between the old and the new appear more sharply than in comparing the barge canal lock-tender with his brother of the old canal. The latter, with his back against a great balance beam and his feet pressing a cleated pathway, might have been seen straining every muscle to close one of the gates, then running across a bridge over the lock to close the opposite gate; next racing to the other end of the lock and out upon the gates to seize and raise the valve lever, and after the boat had been raised or lowered, repeating the operation, all of which had to be performed by main strength at each lockage, and even then only 240 tons of cargo had been locked through. The barge canal lock-tender, at his operating stand near one of the gates, throws successive switches, first to open the gates for the incoming vessel, then to draw into the lock by means of a capstan the boat or, perhaps, a pair of boats traveling tandem or a fleet of four, with their loads of 3,000 tons or more to the pair or fleet. Another switch opens the valves for filling or emptying the lock, both gates and both valves being controlled from either side of the lock without crossing over. All of these operations are performed by electrically-driven machinery, which receives its current from the nearby power house, the head of the water created at the lock furnishing the motive power.

At some of the completed locks records have been kept to determine the average time for performing a lockage. Assuming that the lock is ready for the entrance of the boats, the time required for hauling a fleet into a lock is 7 minutes, and during this time the upper valves are being closed, which operation requires one minute. As soon as the fleet is in the lock, the upper gates are closed, and this takes 45 seconds. The attendant walks from the upper to the lower end of the lock in 1¼ minutes. The opening of the lower valves requires 1¼ minutes. The emptying of the lock takes 5½ minutes, and the opening of the lower gates 45 seconds. Then the getting of the fleet out of the lock consumes 5 minutes, making the total time for a complete lockage 21½ minutes.

The past year has witnessed the completion of one noteworthy canal structure—the dam that impounds the water to form the Delta reservoir. This dam, which stretches across the upper Mohawk valley with a length of 1,100 feet and a height of 100 feet above the lowest foundation, is the chief feature of one of the two projects that will add two lakes to the map of the State. The Delta reservoir, or Delta Lake, as the people in the vicinity prefer to call it, is four miles long and two miles wide at the base of its triangular shape. It reoccupies the basin of an ancient glacial lake. The arrangement of the surrounding hills suggested to the early settlers the name which they gave to the hamlet that nestled in the western part of the valley. This village of Delta has now been obliterated, its site lying beneath the waters of the new lake.

The capacity of this reservoir is 2,750,000,000 cubic feet. Although built primarily for supply purposes, its regulating ability will be considerable. The present low-water flow is from 100 to 150 cubic feet per second and the maximum flood discharge of which we have record is about 8,200 cubic feet per second. It is estimated that, when the gates are properly regulated, the reservoir will limit all summer floods to about 2,500, and winter floods to 2,600 cubic feet per second, thus saving much damage to property in the Mohawk valley.

Work is now progressing on the second great reservoir, that at Hinckley, which is located in the foothills of the Adirondack Mountains, where the drainage basin of West Canada Creek above this point has an area of about 372 square miles. The dam for this reservoir will be, in the main, an earthen structure with concrete core wall. Its total length will be 3,800 feet, the masonry portion being 500 feet long. The reservoir, which will measure 13 miles, counting both branches, has a capacity of 3,445,000,000 cubic feet. In regulating floods this reservoir also will have considerable influence. The natural flow of the stream has a wide variation, ranging from 110 to 40,000 cubic feet per second. It is estimated that proper regulation will reduce a flood of 40,000 cubic feet to one of 19,000 per second, or less than half the maximum rate.

During the past year or two, several interesting phases have been added to the canal question. Among them the terminals rank first. The State was somewhat slow in beginning that part of its transportation system which a railroad company would consider first, but the work of providing suitable terminals is now being pushed rapidly, to have them in readiness for the opening of the canal.

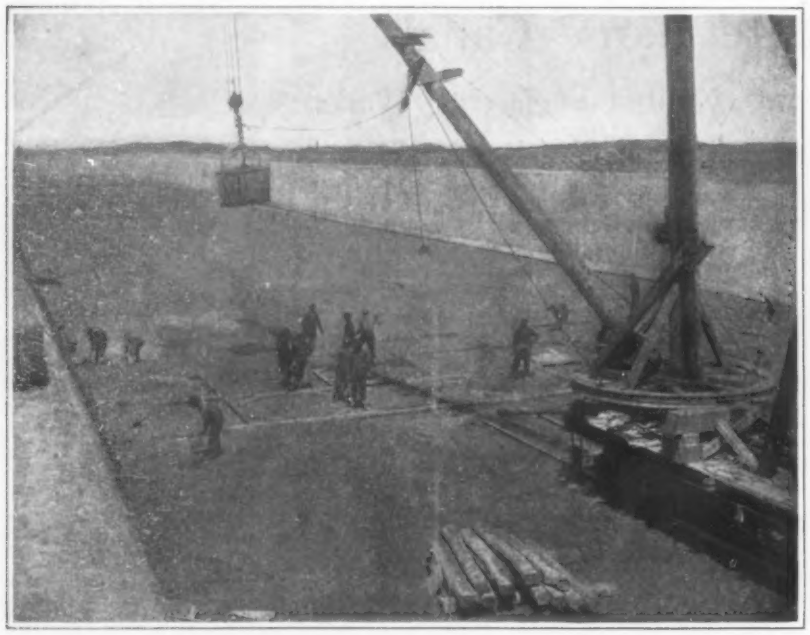
The legislature of 1911 ordered a survey of the Black River between Carthage and Sacketts Harbor on Lake Ontario, to determine the feasibility of making that stream a part of the barge canal system. A bill to provide funds for this addition received favorable action at the hands of the legislature of 1912, but a measure for supplying additional highway funds was given precedence, and only one referendum carrying an appropriation may be submitted to the people at any general election. Probably this subject will come forward for public attention later.

Another matter that will demand future consideration is contained in a recommendation recently made by the State engineer to the legislature. The locks will accommodate boats of 42 or 43 feet beam, but two such boats cannot pass in certain sections of minimum bottom width. In the stretch of 185 miles between Lake Ontario and the Hudson River, by way of the Oswego and Erie canals, there are only about fifty miles of this minimum width. The State engineer has recommended the appropriation of an extra two million dollars to widen these sections and thus to provide a passage for boats of maximum lock capacity from the ocean to Lake Ontario and through the Welland canal to all of the Great Lakes. The use of vessels of 3,000 tons capacity, or over, would be possible by this change.

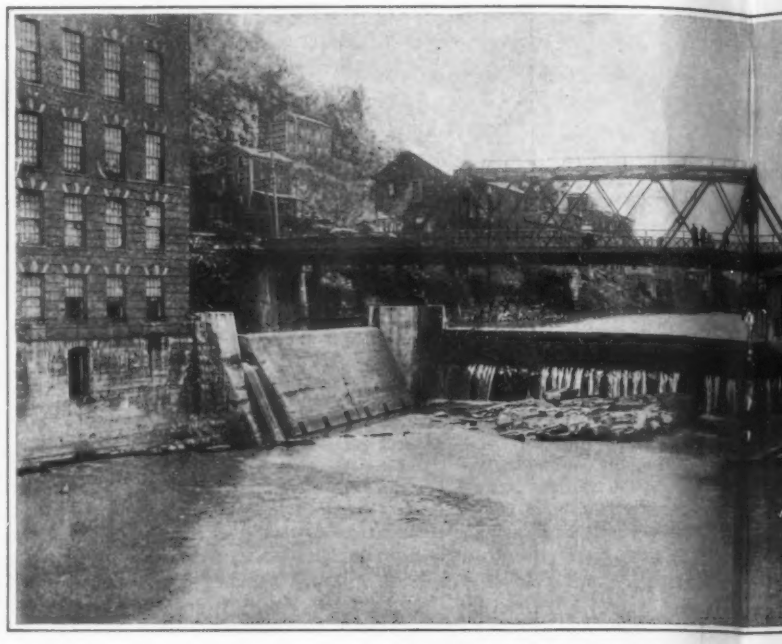
Last summer the passing of two parties of excursionists from foreign lands over the line of the barge canal showed that its fame is recognized beyond the limits of the home country. These parties traveled by private excursion trains and were composed chiefly of representatives of foreign governments, being men who are eminent in engineering and other scientific pursuits. Representatives of the State engineer's department acted as personal guides, and much interest was manifested.

A New Method of Fertilizing the Soil

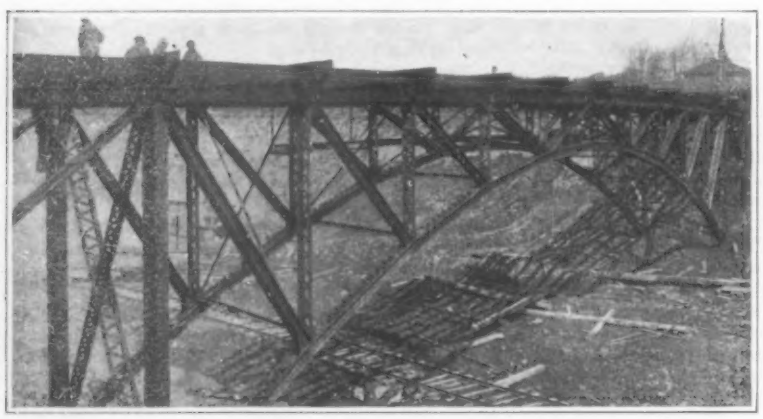
A NEW method of applying chemical fertilizer to fruit trees is proposed by M. Cadoret, and he finds that it gives much better results in experiments which he has been making in France. The usual method is to simply spread or strew the chemical fertilizer on the ground at a certain distance around the trunk of the tree, but the author finds that this has a disadvantage in that the fertilizing principles do not penetrate into the ground as rapidly as might be supposed, so that their action is felt but slowly. He finds that a much better plan is to use an iron rod having an expanded part near the point so as to make rather large holes in the ground. Such holes are filled with the fertilizer, which consists of a properly prepared mixture, using some precautions. The fertilizer, in order to prevent damage to the roots from the caustic action, should be mixed with crumbled earth beforehand. From four to six holes should be used, deep enough so as to contain all the fertilizer required for the tree in question, and the holes are best placed about 12 inches from the trunk. The depth of the holes is increased to keep pace with the growth of the tree. According to the author, the above method gives remarkable results, and he finds that peach, apricot, cherry and other trees of five years' growth are as well developed as other trees of twelve years. The method has the advantage that it does not imply any extra cost. Two men can treat eighty trees a day in this way.



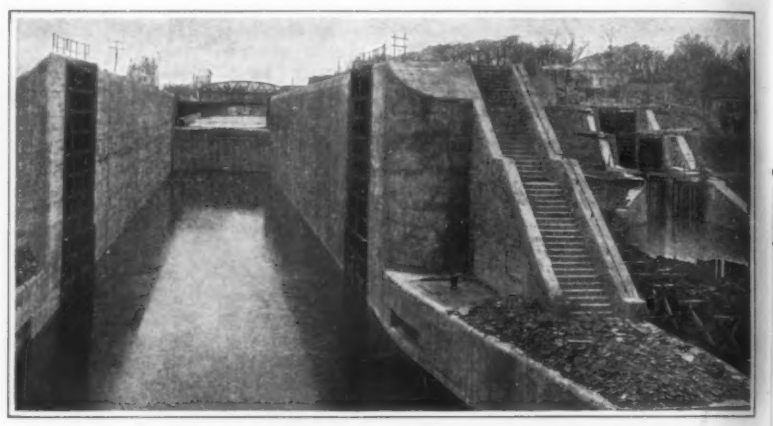
Laying concrete in trough, Irondequoit Creek crossing.



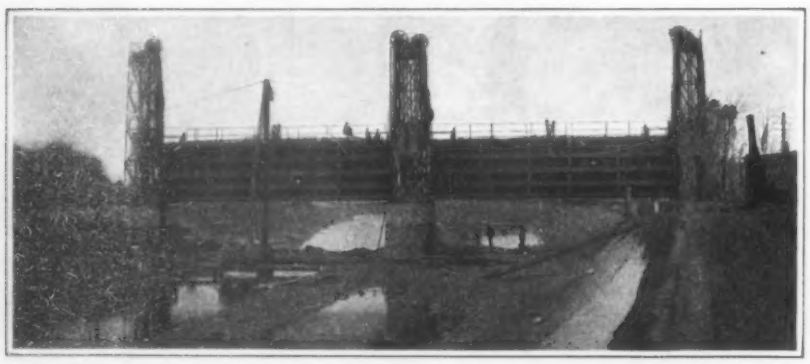
The canal where it enters Lake Champlai



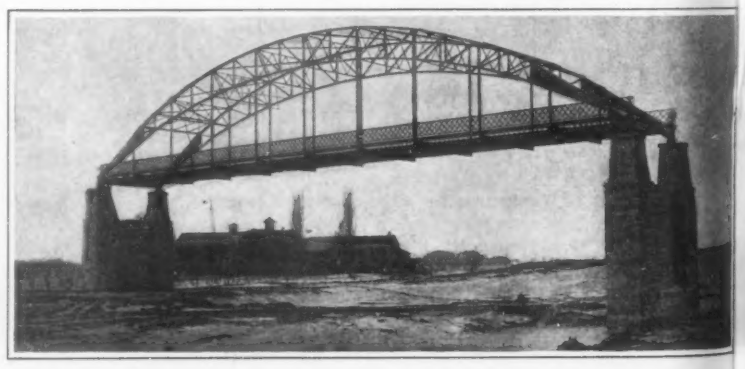
Trussed arch bridge across canal.



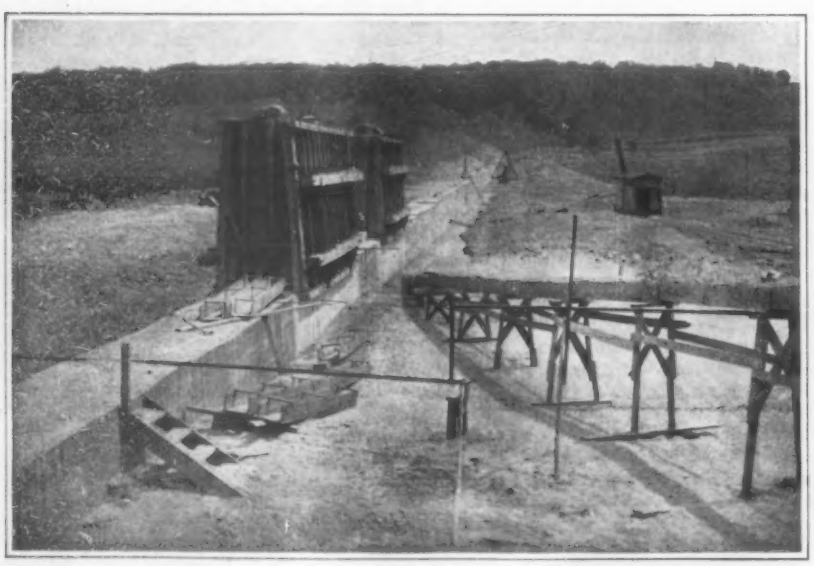
Lock No. 2 at Waterford, eastern terminus of Erie canal.



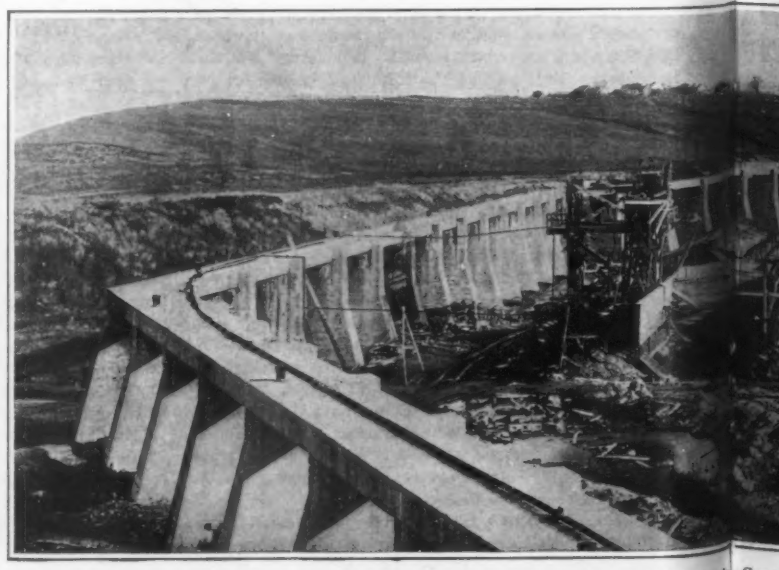
Typical guard gate for cutting off damaged section of canal.



Bridge in embankment section before embankment was placed.



Building concrete core wall for dam at Hinckley reservoir.

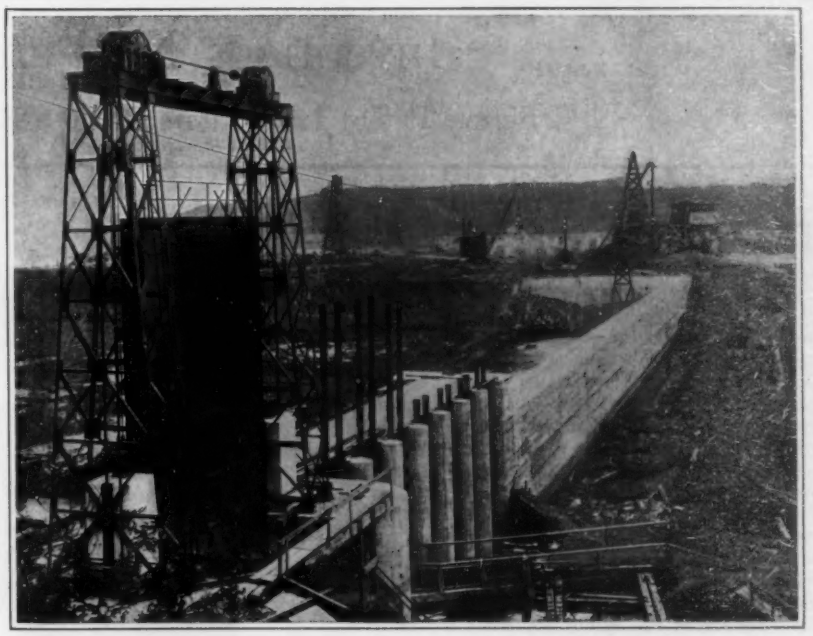


Pool between two of Waterford flight of locks

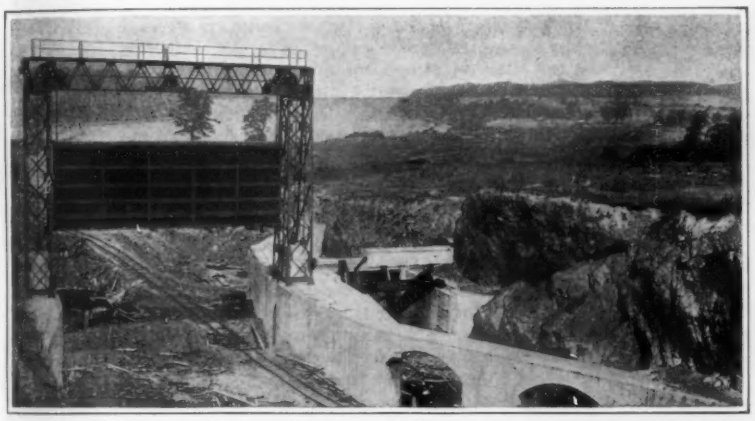
Conc

BUILDING THE BARGE CANAL OF

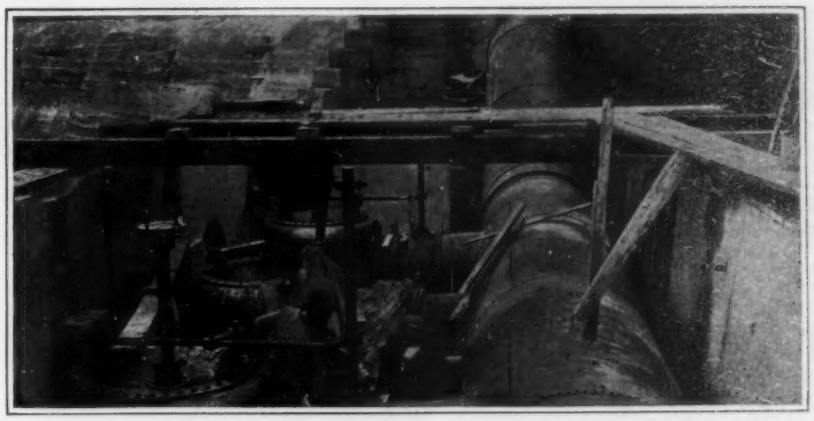
Lake Champlain. Note movable dam and lock.



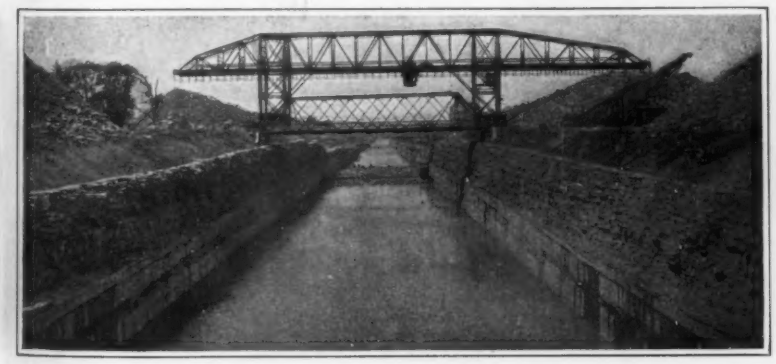
Head gates and Vischeos ferry dam, 2,000 feet in length.



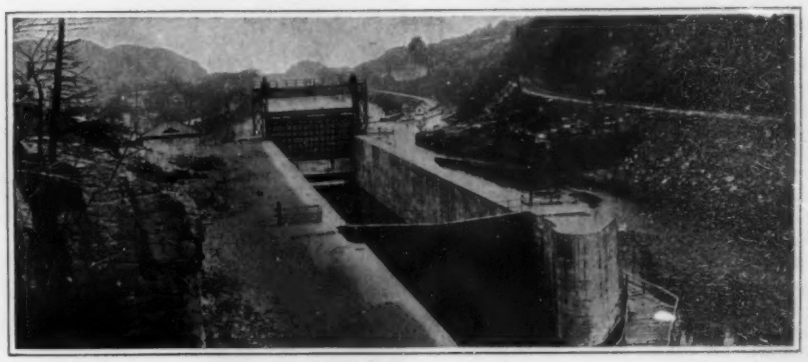
Guard gate at head of cut-off between Mohawk and Hudson Rivers.



Installation of power and light turbines at Crescent dam.

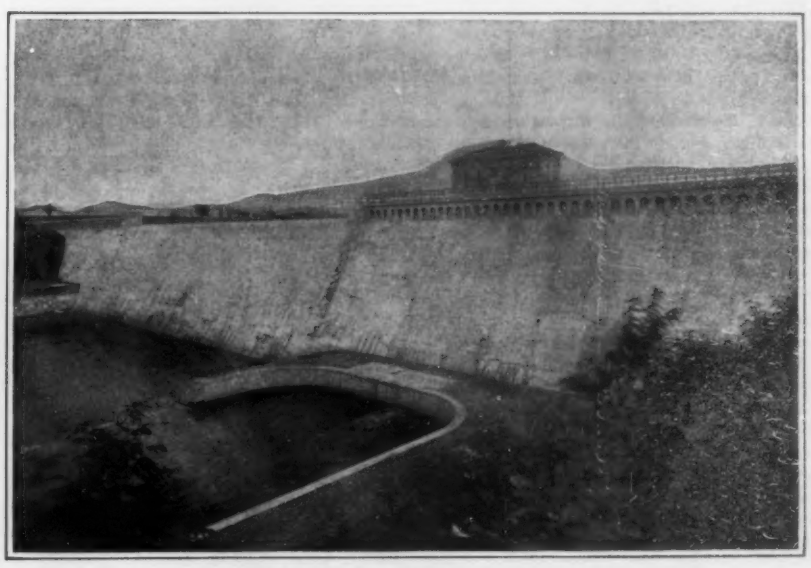


Completed channel in rock cut near Rochester.



The lock at Little Falls with lift of forty and one half feet.

Concrete docking bordering channel within pool.



Completed dam at the Delta reservoir.

OF THE STATE OF NEW YORK

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Moth-proof Fly Book

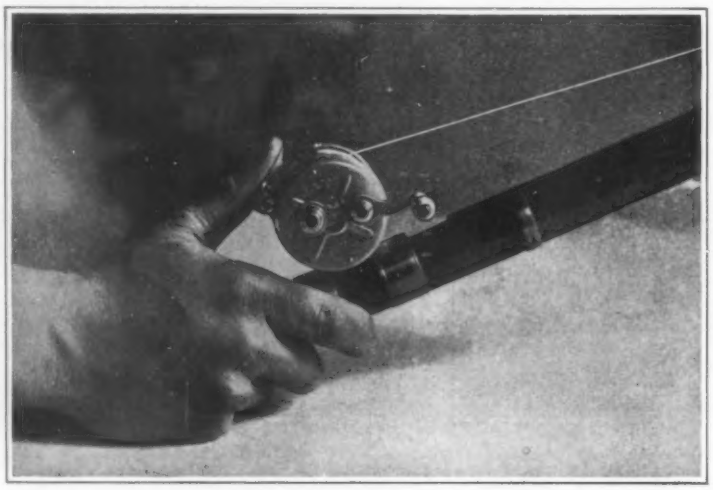
THE importance and value of having a thoroughly good fly book is something that every angler for trout, bass or salmon realizes. Since the earliest days of casting the artificial fly a safe and convenient means of transporting them to and from the stream and of protecting them against moths has been a necessity. To-day, with modern skill and more particularly the adaptation of celluloid to various purposes, we have reached the point where it is possible to make a moth-proof fly book which is in every respect practical. The accompanying illustration shows a book invented by F. J. Cooper of San Francisco. It is constructed on the loose-leaf principle, so that it is possible for the angler to take with him just such flies as he will be likely to need on his trip. The envelopes or leaves are manufactured of a fine linen on the lower two thirds and of celluloid on the upper third. The entire envelope and flaps are strongly bound with twine, to make them durable. The angler will readily appreciate the value of this celluloid upper portion, for it enables him, at a glance, to select the required fly, and avoids the entire necessity of handling flies which are not wanted. It also avoids the possibility of friction, which in the case of the more delicately constructed flies is a matter of considerable importance. On the flap of the envelope is left a space on which the name of the fly may be written. Any number of envelopes may be secured and used as a safe filing place for the angler's stock of flies. The book is provided with a separate linen envelope for leaders; also a solid leather pocket for other requisites of an angler's trip. Ample space is allowed for six or eight fly envelopes. Being completely inclosed, the flies are protected from moths.

A moth-proof fly book.

Fishing Reel

THE fishing season is close upon us, and every follower of Walton will soon be thinking of going over his outfit in preparation for the season's sport. Next in importance to his rod, if not as important as that article, is his reel. All who have cast a live bait, spoon or fly, know the value of a thoroughly substantial and reliable reel.

In this part of his equipment, as in all things connected with angling, simplicity is of the greatest importance. A reel which has recently been put upon the market is shown in the accompanying illustration. In appearance it is in keeping with the finest outfit, but appearance is not its only good quality, for its mechanism is of the simplest kind, yet it is constructed so as to overcome many of the difficulties encountered in casting, such as the tendency of the spool to overrun, the wedging of the line at the ends of the spool, and the spoiling of the line by thumbing the outside layers, for with this reel it is not necessary to touch the line in casting.



A simple fishing reel.

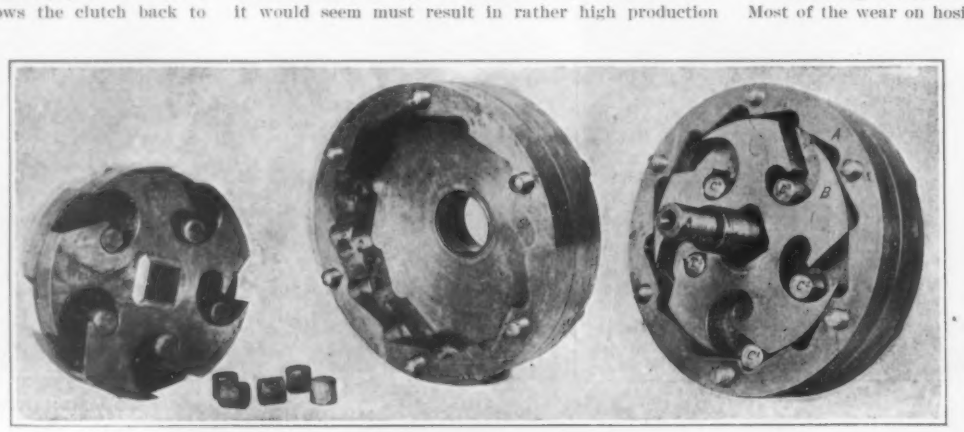
The thumbing lever, by which the spool is freed, and the brake applied to the center of the spool, make it possible to control the bait at will. When the thumbing lever is pressed down to hold the spool tight, preparatory to the cast, it automatically throws out a crank and gear mechanism, so that the spool revolves freely. After a cast is made, to wind in, you merely press the crank toward the reel, and this throws the clutch back to action, the spoon turning with the crank. It is extremely simple. Press the lever and the spool is free. Press the crank and the spool is again in engagement.

The frame of the reel is of German silver, with the crank end removable, making the spool and other operating parts readily accessible. The spool is made from aluminium. As a reel for bait casting, particularly, it is of unusual value to anglers, for upon releasing the lever, the bait easily accelerates the light spool, which is unhampered by either crank or gears. The bait is thus permitted to attain high speed.

A Gearless Automobile Differential

By Ross Babcock, M.E.

BY way of overcoming the shortcomings of the very common type of automobile differential mechanism, there recently has been brought out by a Detroit inventor a new style of gearless differential in which the problem of obtaining equal distribution of power to both driving wheels has been attacked in a manner that differs from any other. Not only are gears eliminated, but springs and friction devices also are missing, for which reason great claims are made for it. Whether it ever will come to anything remains to be seen, for its manufacture suggests a number of difficulties that it would seem must result in rather high production cost; this fact is made plain by the accompanying illustrations. In the mean time, however, it is being tested on a heavy commercial vehicle by one of Detroit's greatest axle makers, and the results of the tests will determine largely its future.



A gearless automobile differential.

The construction of devices of a similar nature has been attempted before, as witness the patented inventions of such noted engineers as Thomas B. Jeffery and Alanson P. Brush and others, though in the new gearless differential the principles adopted or adapted by others in attempts to solve the problem have been relegated to the background.

In its simplest aspect, the device is an adaptation of the well-known ratchet and pawl mechanism, though it differs from it in that both springs and ratchets are eliminated. The place of the former is taken by gravity alone and the place of the latter is taken by small cylindrical pins which are free to move within peculiarly shaped slots. The device illustrated was developed for use on commercial vehicles, two being employed, one on either end of the driving jackshaft, which is solid and is driven in the orthodox manner by means of a ring bevel gear and pinion from the engine.

The outer member *A* has its inner periphery recessed as shown, one set of recesses serving for forward drive and the other set serving for reverse and braking. A plate mounting the driving chain sprocket is bolted to this member and serves also as a cover for the mechanism. The inner member *B* is slotted as shown in the picture and the slots house five cylindrical pins C^1, C^2, C^3, C^4, C^5.

In operation, when the inner member *B*, which is splined to the driving axle, is rotated, one of the pins rolls around its slot to the position shown in the picture C^1, thus preventing further movement of the inner member without moving also the outer member *A*, to which the driving chain sprocket is attached. The drive thus is dependent upon a single pin. In the reverse direction the other set of pawl pins comes into action. In order to minimize the jar coincident to starting from rest the pawl cams at either end of the jackshaft are set one 45 degrees ahead of the other, so that one eighth revolution of the driving shaft in either direction serves to lock the driving and driven members.

When the vehicle is being driven along a straight road, the pawl cams on each side lock and transmit the power equally to both wheels, provided the coefficient of adhesion between each wheel and the road is the same. Immediately a curve is reached, however, the outer or faster running wheel over-runs its pawl cams and the inner wheel receives all the power. When one wheel encounters slippery roadway the lack of adhesion between wheel and road operates to release the pawl cams on that side and the drive then automatically is taken by the other wheel, where better traction is obtainable. Under similar conditions with the ordinary type of differential all the power would be transmitted to the slipping wheel and it would continue to slip, performing no useful work. Hence, the gearless differential would seem to be a better equalizer than is the other.

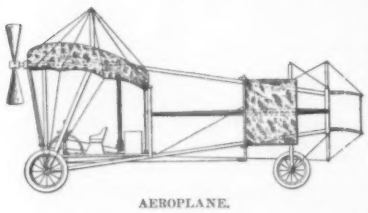
Advertising Device to Show Wear of Stockings.—Most of the wear on hosiery comes at the toe and heel. A patent, No. 1,052,825, has been issued to the United Demonstrating Machine Company of Columbus, Ohio, as the assignee of Ernest S. Jaros of the same place for an advertising device in which two stockings are spaced apart and a sledge vibrates between the two, striking alternately the heel of one and the toe of the other, and a register indicates the number of strokes of the hammer, so that it can be determined how many strokes of the sledge are necessary to wear out the stocking.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

AEROPLANE.—W. D. SCOTT, Box 92, Springwells, Mich. This inventor provides means for producing a warping effect without impairing the structural strength of the carrying planes; provides a mechanism universal in its operation for controlling the steering and



AEROPLANE.

warping devices harmoniously; provides a tail carrying plane for steadying the horizontal poise of the machine; provides a system of duplex steering rudders to augment the effectiveness thereof; provides a structure for the planes which augments the strength without materially increasing the weight thereof; and provides means for steadying the operation of the planes in their passage through the air.

Of General Interest.

COMBINED TEETH SEPARATOR AND MIRROR.—B. L. MILLER, 324 Wall St., Kingston, N. Y. The invention refers to dental appliances, and the aim is to provide a form of combined teeth separator and mirror arranged to permit of illuminating and reflecting the cavities of teeth to be filled, or to illuminate the teeth while polishing a completed filling.

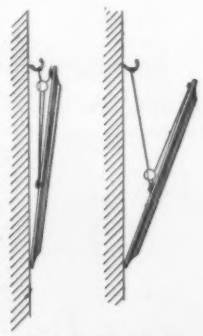
ATOMIZER.—N. RACHMANN, Haida, Bohemia, Austria-Hungary. In this device the fixing of the piston rod simultaneously secures the suction valve in its closed position. This not only produces a double obturation by the fixing means and suction valve, but the latter acts directly as a firmly inserted stopper so that in an atomizer of this kind sensitive and volatile perfumes and the like can be kept for a long time as well as in a tightly stoppered bottle. Thus perfumers can market their products directly in atomizers, which has not hitherto been the case.

Hardware and Tools.

HINGE.—F. W. HEETER and P. KLINE, 903 State St., Racine, Wis. The invention provides a hinge which can be used for the various purposes to which hinges are usually put, which can be readily attached to or detached from the door frame or other support, without the removal of retaining bolts, screws or nails, and which cannot be easily accidentally detached.

TAPE CASE.—G. F. PUTNAM, care of Standard Rule Co., Flint, Mich. In the present invention the principal object of the inventor is to provide a new and improved tape case, the construction of which presents a series of corrugations or roughened portions between the opposite sides thereof whereby the case may be held in the hand more securely.

CLAMPING DEVICE.—J. HUBER, 220 N. 4th St., Saginaw, Mich. This invention has reference more particularly to the combination with a picture wire or other flexible member adapted to be attached to the picture or other



CLAMPING DEVICE.

article to be hung, of a clamping device by means of which the effective attachment between the picture and the flexible member can be varied to vary correspondingly the angularity with the horizontal of the article when it is hung.

Heating and Lighting.

RADIATOR.—E. H. TROTTER, care of Trotter Commission Co., Columbus, Ohio. The invention relates to a form of gas stoves and radiators, and an object of the improvement is to construct a gas stove having relatively large heating surfaces compared to the combustion space, and having said heating surfaces so constructed that a large part of the heat will be radiated downward.

ACETYLENE GAS GENERATOR.—J. F. WILLIAMS, 41 Warren St., New York, N. Y. In this generator the amount of carbid in the feed hopper is indicated at all times, and an alarm is sounded whenever the carbid in the feed hopper reaches a low stage, and whereby a supplementary charge of carbid within the hopper may be added to permit of running the acetylene gas generator another length of time, say overnight, before being required to recharge, thus avoiding recharging during the night or running out of gas and thereby avoiding the consequent extinguishing of the lights.

Household Utilities.

ROPE CLAMP.—F. A. WARTER, 99 Madison Ave., Perth Amboy, N. J. The clamp is provided with a member which may be used as a handle, the member extending through a cut-away portion of a guide arm, which is pivoted to the member so that the movement of the arm relative to the member is limited in one direction by the contact of the member with the arm. The invention is especially well adapted for operating pulley lines.

ADJUSTABLE BRACKET.—E. CHANAL, 2170 Amsterdam Ave., New York, N. Y. An object here is to provide an inexpensive adjustable bracket easy in its manipulation and positive in its action, that can be easily put on or off from the supporting place. Another object is to provide an adjustable bracket that will permit a displacement of the supported object without displacing the bracket itself.

FLY TRAP.—J. B. MEADOWS, P. O. Box 138, Yukon, Okla. This inventor's more particular purpose is to produce a device which is sanitary, and in which the parts are so constructed and fitted together that they may be readily nested for purposes of shipment and readily placed together to form the complete trap.

Machines and Mechanical Devices.

TORPEDO PLACING MACHINE.—J. D. BELL, Arcadia, Kan. This invention provides means whereby a plurality of torpedoes may be successively and rapidly deposited on the rail of a railway bed; and simplifies the construction so that the retraction of the holder, after the deposit of one torpedo, disposes a succeeding torpedo in position to be deposited.

SUBMARINE MINE.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. In this case the spring controlled striker is connected to the anchoring device in such a manner that its movements relatively thereto are controlled by a movable arm which, on the mine being struck, is so moved as to allow the striker to be automatically cocked and then released to cause explosion of the mine.

GEARING.—E. W. F. HERRMANN, 120 Hays St., San Antonio, Tex. This invention relates to gearing, and an object is to couple up at will two independent drive shafts with two independent engines, so as to direct either engine with either shaft, both engines with either shaft, or both engines with both shafts.

VENDING MACHINE.—J. J. MARRS, Harrison, Ark. The purpose here is to provide means which, when freed by a coin, are adapted to operate to discharge a newspaper or other periodical from within the casing. Another purpose is to provide means which may be readily adjusted to regulate the tension of the spring connected with the lever, so that one, two, three or more coins will be required to operate it.

APPARATUS FOR DISPENSING TOWELS, NAPKINS, AND THE LIKE.—P. G. MERRITT, 1931 Berlin St., New Orleans, La. The object of the present invention is to provide an apparatus for containing and dispensing towels, napkins and similar articles as they are required for use, and more particularly to contain and dispense such articles assembled in the form of rolls, such rolls of articles being produced by a rolling apparatus forming the subject matter of a filed application.

HYDRAULIC AIR COMPRESSOR.—C. HEIRICH, 35 Ubierring, Cologne, Germany. This inventor makes the separating and storage chamber and sometimes the descending-pipe also, of rubber-coated fabric, so that the apparatus can be assembled above ground, then lowered through the narrow shaft in a folded or rolled condition, and finally expanded or inflated in suitable manner. As these can take place without difficulty under water when his apparatus is employed it is not necessary to pump out the water or to provide tubbing and consequently it can be used in even very wet or flooded ground. The means employed enables hydraulic compressors or accumulators to be sunk and anchored in the sea.

WEIGHING SCALE BALANCING LEVER.—C. M. STURGIS, 1601 Fifth Ave., N., Birmingham, Ala. This improvement provides a lever adapted to receive the balancing edges and links therefor in guided relation; provides a simplified construction for said lever without diminishing the strength thereof; and provides an economical form of construction for the said lever.

PROPELLER.—G. A. SMITH, J. E. BROOKS, G. E. BOWMAN, and H. H. SLEPPY, address George A. Smith, Wilmington, Cal. The invention pertains to propellers of the reciprocating type, and comprises a pair of leaves or blades pivoted together and connected to the end of a reciprocating rod, such as a piston rod, and provided with braces which control the opening and closing of the blades.

APPARATUS FOR BENDING AND CUTTING STEEL RULES AND OTHER METAL BARS.—J. A. RICHARDS, Albion, Mich. The invention is in certain features an improvement upon the rule-bending apparatus for which Mr. Richards has received Letters Patent No. 998,394. In the present invention he has combined improved means for bending, shaping, and cutting rules and other bars, whereby important advantages are attained.

DRIVING MEANS FOR GRAMOPHONES.—F. G. HAYWARD, 50 Convent Ave., New York, N. Y. The object here is to so improve frictional driving means as to provide for a substantially constant pressure upon the driving face of a transmitting disk even though certain of the friction wheels co-operating therewith may be shifted in relation to one another or the axis of the shaft upon which the said disk is mounted.

PACKING BOX.—W. T. SNELL, Bisbee, Ariz. The invention relates generally to a form of packing box in Letters Patent No. 1,018,938, granted to Mr. Snell. The present invention is directed to a box characterized by an arrangement of parts whereby the packing will follow the piston rod or equivalent element when the rod or element runs out of center.

MACHINE FOR THREADING TAPES INTO BUTTONS AND OTHER ARTICLES.—L. ROSENMAN, care of W. Raubitschek, 174 North 4th St., Brooklyn, N. Y. For the purpose of this invention use is made of an abutment for the article to rest on and a tape carrier adapted to pass through the apertures in the article and adapted to carry a tape and draw the ends through the said apertures in the article.

YARN STRIPPER.—J. W. MULLIKIN, care of John P. King Mfg. Co., Augusta, Ga. This invention pertains to yarn strippers employed for stripping threads and yarn from bobbins and quills, in order that the latter may be filled with a new thread or yarn. The inventor seeks to provide a simple mechanism by aid whereof the thread (usually termed in this art as the yarn) is readily slipped off from the bobbin or quill.

VENDING MACHINE.—C. A. BRYANT and C. H. ROUNDS, Passaic, N. J. This machine is more especially designed for vending keystone-shaped flat drinking cups in public places and the like and arranged to insure the delivery of a cup after the proper coin is once introduced and a controlling handle is manipulated, and to prevent the delivery of a cup unless the coin is first introduced.

APPARATUS FOR USE IN THE TREATMENT OF DEAFNESS.—A. ROSENBERG, 259 High Holborn, London, W. C., England. This device treats deafness and other disorders of the auditory organs and by agitating the sound-conducting and sound-perceiving portions of the ear by means of mechanical vibrations having a continuous undulatory character corresponding to that of the sounds (speech, music and the like) to which it is required to train the ear to respond.

CLOCK WINDING DEVICE.—C. T. BERNHARDT, Box 544, Salisbury, N. C. In the present patent the purpose of the invention is the provision of a clock-winding device in the form of a self-contained unit attachable to the spindle of the winding barrel of the clock, and bodily removable therefrom when desired.

LATH MACHINE.—T. H. HYDE, care of E. E. Patton, 1000 Fifth Ave., New Kensington, Pa. This machine is for use in expanding sheet metal into an open-work fabric. The present forms of machines are objectionable in that they are formed of a large number of parts which are quite apt to get out of order and the replacing of which parts is difficult and expensive.

SLOT MACHINE.—A. H. BOWMAN, 134 So. 14th St., Allentown, Pa. This invention relates more particularly to that class of machine adapted to dispense gum or other commodity upon the insertion of a coin in a slot. An object is to provide a device which will allow the passage of coin, but which will intercept washers or slugs.

CLOTH PILER.—J. LAUGHTON, care of W. H. Rich & Son, 768 Pacific St., Brooklyn, N. Y. The present invention refers to cloth pilers and more particularly to cloth pilers adapted for use in handling fine textile fabrics such as silks used in manufacturing umbrellas and parasols. It provides a carriage, also guides which acting upon the material as it is paid out from the cloth laying carriage, causes it to be properly laid and positioned on the cutting table.

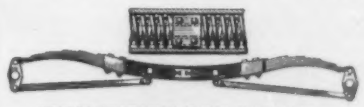
Railways and Their Accessories.

CAR SEAL.—J. W. BOWER and H. W. GREEMANN, care of Harvey W. Greeman, 222 W. 4th St., Seymour, Ind. The seal comprises a body member and a co-operating extension carried thereby; it is obvious that the sizes of the body member and the extension may be varied in order to adapt the device to different uses, the materials of which the parts are made being also capable of wide variation without departing from the inventive idea.

CAR WHEEL.—G. T. POTTER, Connellsville, and C. B. PRITCHARD, Everson, Pa., and O. L. MARQUET, address the last named 907 Market, Steubenville, Ohio. The invention provides a cover for a lubricant-box, which may be quickly and readily removed to expose the major portion of the interior of the box; and provides delivery passages for the lubricant to guide the same laterally over the journal bearing of the axle whereon the wheel is mounted.

Pertaining to Vehicles.

SPRING SUSPENSION FOR VEHICLES.—H. L. HUBBARD, 223 W. Willis Ave., Detroit, Mich. In this patent the inventor brings out an improvement wherein the section of a



SPRING SUSPENSION FOR VEHICLES.

frame shows a movable steel block operating between two coil springs which can be used in connection with a spring hanger frame attachment either for the use of the half elliptic spring as used on gasoline motor cars or the radius rod adjustment as used on electrics.

VEHICLE MOUNTING.—A. A. PRATT, care of Beardsley, Hemmens & Taylor, 54 Wall St., New York, N. Y. The intention here is to provide a mounting or suspension, arranged to insure easy and comfortable riding in the vehicle without requiring the use of pneumatic or similar tires, thus reducing tire expense to a minimum and eliminating danger and delay caused by bursting tires and the like.

FLUID TRANSMISSION FOR MOTOR VEHICLES.—E. B. VAUGHAN and F. T. KLASGYE, Cleveland, Ohio. The improved power transmission apparatus employs a circulating turbine driven by a motor and in circuit with two turbines on a reversible drive axle. The propelling turbines may be reversed, there being for the purpose controlling valves in the liquid circulating circuit whereby the liquid may be directed either under or over the propelling turbines to turn them in either direction for forward or reverse drive.

Designs.

DESIGN FOR A WIND SHIELD.—W. H. DOUGLAS, Belleville, N. J., care of Healey & Co., 1652 Broadway, New York, N. Y. In this attractive design for a wind shield the shield holds two oval-shaped glass protectors ornamentally set in the frame supported by posts.

DESIGN FOR CARPET OR RUG.—J. G. PEGEL, Thompsonville, Conn., care of G. S. Squire, 25 Madison Ave., New York, N. Y. Mr. Pegel has obtained patents on four designs for a carpet or rug, all of which are oblong in form and ornamented with a border inclosing the scene presented. Design No. 43,775 shows pictured on the field of the rug two little children at seesaw with a small dog standing midway of the opposite ends of the plank. Design No. 43,776 shows a park scene with a boy and girl handling three pet dogs. Design No. 43,777 depicts an outdoor scene wherein five small girls are romping around a path in single file and holding the bottom of one anothers' skirts. Design No. 43,778 represents a garden inclosure with a girl playing with four kittens and a very large sized dog.

DESIGN FOR CARPET OR RUG.—W. E. SAYERS, Thompsonville, Conn., care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this ornamental design for carpet or rug an outer and an inner band with ornamental patterns comprise the border. The field with its centerpiece is designed in very attractive geometrical figures.

DESIGN FOR A CARPET OR A RUG.—W. O. DEWSBURY, care of G. S. Squire, 25 Madison Ave., New York, N. Y. In this ornamental design for carpet or rug inside of the somewhat plain border flowers and scroll work are in profusion. The centerpiece is very attractive with its design of flowers and scrolls.

DESIGN FOR A TUMBLER.—W. E. HUNTER, Morgantown, W. Va. In this design for a tumbler the glass is of straight vertical outline. The ornamental feature comprises a single narrow twisted band around the upper part and another below looped around the article.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

WE wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized, technical, or scientific knowledge required therefor.

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Patent Attorneys,
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The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

End Dump Bodies for Commercial Vehicles

(Concluded from page 378.)

nut *11* to travel either up or down, raising or lowering the body.

Passing from the screw and nut operating mechanism, the rack and pinion mechanism illustrated in Figs. 4 and 4A probably is the simplest of all those illustrated. It is so simple in fact that it scarcely requires explanation. The curved rack *12* is attached to the body and operated by the pinion *13*, which in turn is operated through a train of gears giving the required reduction. A hand crank connected at *14* serves to operate the train of gears and the muscle of the driver is the elevating energy.

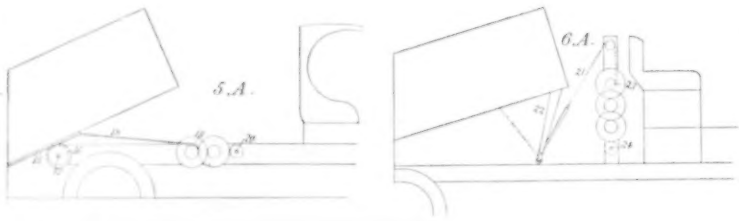
In Figs. 5 and 5A the rack and pinion principle also is employed, though the method of application is quite different. The rack *15* is mounted on the body. Rotation of the pinion *16* by means of a crank attached at *17* serves to move the body backward until it over-balances and tips itself. To draw it back into position, a chain *18* winding on a drum *19*, which is operated through a train of gear wheels set in motion with a crank attached at *20*, is employed.

With the aid of a special "fifth wheel" arrangement the body illustrated in Fig. 6 has been made particularly adaptable for use in constricted areas where it is impossible to back the vehicle into position for unloading. The body is swung around by hand (the "fifth wheel" is mounted on rollers) and dumped manually through a combined chain hoisting and movable fulcrum arrangement, shown diagrammatically in Fig. 6A. In operation, the chain *21*, which is attached to the arm *22*, is wound up on a drum *23* through a train of gears set in motion with a crank attached at *24*. The arm *22* has a roller at its lower end which travels on a metal track, thus reducing friction to the minimum. The body returns to its normal position by gravity.

A somewhat similar arrangement is shown in Figs. 7 and 7A, though the method of application of the movable fulcrum is quite different. The arm *25* is pivoted to the body and travels on a track on the chassis, the chain *26* being attached at its lower end, and wound up on a drum *27* operated through a train of gear wheels by a hand crank attached at *28*. Thus, winding up the chain draws the arm *25* to the rear and hoists the body, which returns to its lowered position by gravity alone.

Operating on the rolling fulcrum principle, which permits the application of the greatest power at first, with a gradual diminishing of power as the load is raised into position and less effort is required to raise it, the arrangement depicted in Figs. 8 and 8A is unusual and is different from any of the others. The arm *29* is pivoted to the body and operated by the chain *30* running over a chain wheel *31*, which is worm-driven from a shaft *32*, driven in turn by spur gears from the propeller shaft. The body is hauled down by reversing the motion of the shaft *32* by means of an idler gear controlled by the driver from his seat.

The mechanism governing the hydraulic hoist shown in Figs. 9 and 9A is operated from a countershaft extended at the front end of the gear set. On this shaft are mounted respectively a chain sprocket and a driving clutch. A lever permits the clutch to slide along the shaft and engage with the sprocket. Alongside the gear set there is a countershaft mounted in ball-bearings from which a rotary oil pump is driven. The pump is connected to the cylinder of the hydraulic ram by means of a suction pipe *33* leading into the top of the cylinder. The oil under pressure forces the piston *34* up until the top of the stroke is reached, at which point a strike valve opens three ports in the piston, allowing the oil to escape freely into the top portion, thereby holding the body at rest. The actual lifting of the body is accomplished through the intermediary of a flexible steel cable *35* passing over two sheaves *36* and under a central third sheave *37*. Thus, for a given lift of the piston the body is raised twice the height. The third sheave acts as a compensating device equalizing the lifting force on both sides of the body. The whole mechanism is firmly braced to the chassis, but in such a manner that it can be detached as a complete unit without disturbing the truck chassis itself.



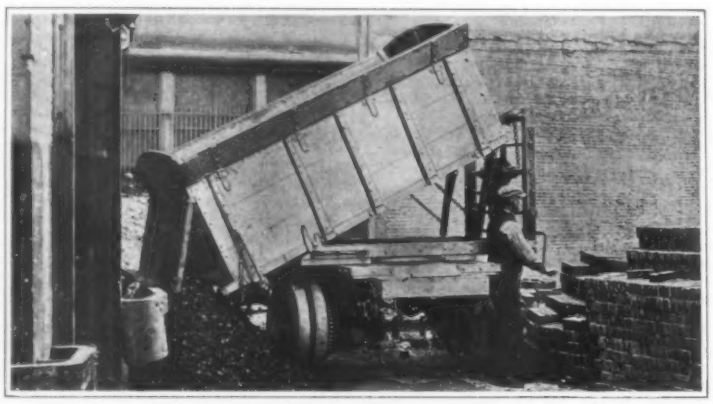


Fig. 5A.—Details of Fig. 5. Figs. 6 and 6A.—Swiveling dumping body.

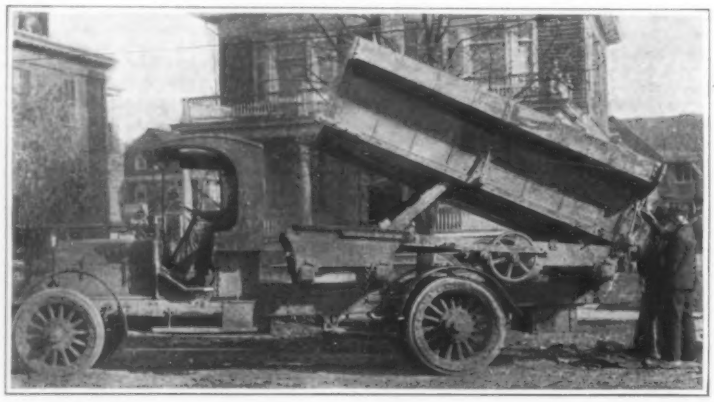


Fig. 7.—Elevating gear employing a sliding fulcrum.

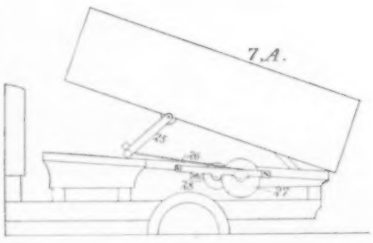


Fig. 7A.—Details of sliding fulcrum.

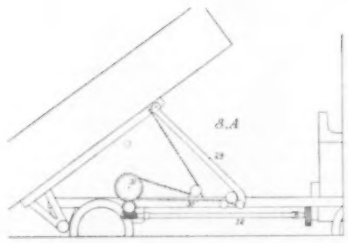


Fig. 8A.—The rolling fulcrum.

Horse Trucking Costs Estimated by a Team Owners' Association

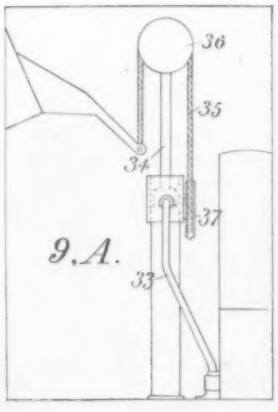
ONE of the problems which the motor truck transportation engineer has to face when he comes to compare motor vehicle with horse transportation costs is the lack of any definite figures on the cost of using horses.

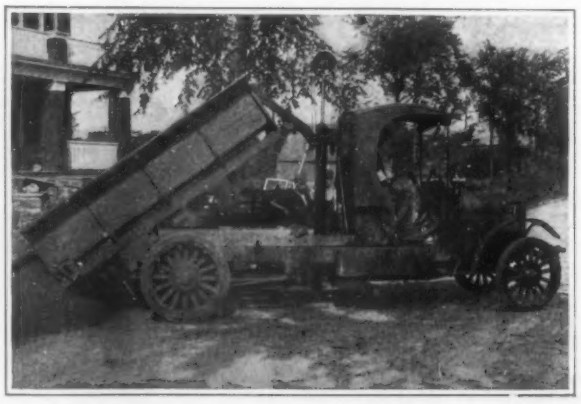
Members of the Team Owners' Association of Boston, which is made up of a hundred or more of the leading men engaged in the trucking business of that city, recently became involved in a discussion over this question, which resulted in the employment of a certified accountant to investigate the subject, and his report was read before a meeting of the association. This report is in part as follows:

"To start with, there are 365 or 366

(Concluded on page 384.)

Fig. 8.—The rolling fulcrum varies the leverage as required.





Figs. 9A and 9.—Raising a car body by hydraulic pressure on a piston.

END DUMP BODIES FOR COMMERCIAL VEHICLES

The Final Choice of the Discriminating Purchaser

After trying out several different types of motor trucks for the past two years, The Atlantic Ice and Coal Corporation, of Atlanta, Georgia, has recently ordered fifteen White Trucks for immediate delivery.

Responsible firms prefer to purchase truck equipment from responsible manufacturers. This is one of the reasons why the final choice of the discriminating purchaser is invariably White.

Another point of importance is the fact that White Owners continue to buy White Trucks. When Whites are used, experimentation ceases.

White Trucks are the most economical trucks to operate.

THE WHITE COMPANY
CLEVELAND

Manufacturers of Gasoline Motor Cars, Trucks and Taxicabs

29 More G. V. Electric Trucks

For the New York Railways Company

The Third Avenue Railway Company received their first G. V. Emergency Wagon in May, 1911. Today they have in all 8 G. V. Trucks.

What is now the New York Railways Company bought their first G. V. Truck in November, 1911. On March 25, 1913, they placed their entire order for new electric truck equipment with the General Vehicle Company, Inc.

The order calls for the following machines:—

1 1000 lb. wagon with express type body.
2 1000 lb. wagons with panel bodies.
1 2000 lb. panel money wagon.
5 2 ton emergency wagons.
14 3½ ton trucks with steel dumping bodies.
4 3½ ton trucks with platform and stake bodies.
2 5 ton trucks with platformtand stake bodies.

This order represents an investment in G.V. Electrics of over $100,000.00.

Over 100 other public utility corporations, including some in Manila and Rio de Janeiro, use G. V. Electrics and many of these are standardizing on the G. V. product. They can safely do so, for money can buy no better.

We can offer you **road transportation machinery** proven by 12 years' use.

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General Office and Factory **Long Island City, New York**

New York Chicago Boston Philadelphia

One touch of Nature and the World's akin—
The lot, the worm, the crooked pin

Your Week-end, Your Hupmobile And a Breath of Life in the Open

The fleeting Hupmobile—the car that "runs wherever a dog can"—turns at last into Farmer Hoskins' lane.

You remember that Day—the one Perfect Golden Day. It is given to each of us to Live and Treasure just one such day. Dawn was just breaking—a spring day, the Dawn of a New Summer—when you and Billy and Ned and Steve left the drowsy city street and streaked for that Lake.

But Hoskins, Junior, has beaten you to it. He grins through his freckles, holds up his string and then leads you off through the hickory grove to the Enchanted Lake of your Dreams.

* * *

Then, when the shadows are slanting through the hickories and the fish stop biting, you pile into the Hupmobile, and wing through the falling evening back to the city—in actual miles very far from the Lake of your Dreams, but in the Hupmobile—very near.

* * *

You, who long for freedom now and again from the every-day grind—can have *your* perfect day, too, with a Hupmobile.

And at a cost ridiculously small, as automobile costs are measured.

The Hupmobile is distinctly a car of the American family. It is the only car that both millionaire and man of moderate means can approve; for there is no other car with style, stamina, comfort and power that so closely approaches its companions of costlier price.

Build your week-end plans around a Hupmobile, give your loved ones such a Summer as they have never known, with this sturdy Car of the American Family.

Write for catalog and the Hupmobile dealer's name.

Hupp Motor Car Company, 1233 Milwaukee Ave., Detroit, Mich.

Hupmobile

Hupmobile "32" Touring Car, $1000 f. o. b. Detroit

In Canada, $1180 f. o. b. Windsor

Four-cylinder motor, cylinders 3¼-inch bore by 5½-inch stroke, cast en bloc. Unit power plant. Sliding gears.

Full floating rear axle.

Wheelbase, 106 in. Tires, 32x3½ in.

Equipment of windshield, mohair top with envelope. Jiffy curtains, speedometer, quick detachable rims, rear shock absorber, gas headlights, Prest-o-lite tank, oil lamps, tools and horn. Finish, black with nickel trimmings

"32" Six-passenger, $1200
In Canada, $1430
"32" Roadster, $1000
In Canada, $1180
"29" H. P. Runabout, $750
In Canada, $850

F.O.B. Detroit *or Windsor*, fully equipped.

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A Hupmobile week-end on the banks of "that" trout stream.

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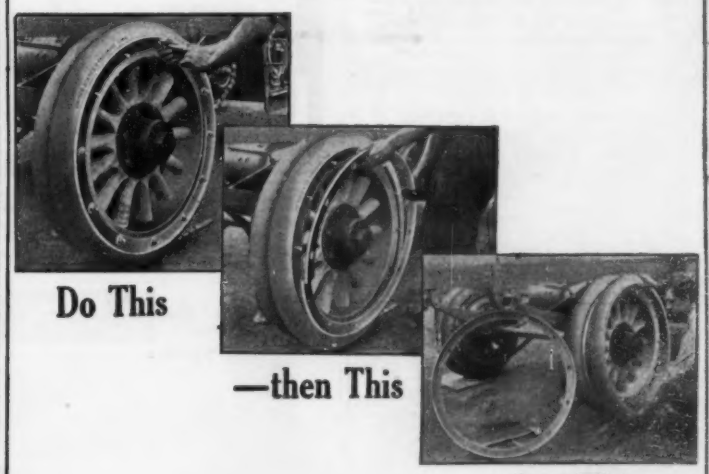

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—then This

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It is costing us still one hundred thousand yearly for research and experiment.

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You can see that No-Rim-Cut tires make rim-cutting impossible. That's an enormous saving.

With old-type tires, rim-cutting ruins 23 per cent.

You can see the oversize. And that 10 per cent oversize, under average conditions, adds 25 per cent. to the tire mileage. Those savings need no argument. They are too apparent.

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STEEL ROW BOATS AND CEDAR CANOES

days in a calendar year. A horse, to take the horse as a unit, must be fed, housed, maintained and cared for during the 365 days, but to get his earning capacity, excepting the unusual occasions of a few Sundays or night work, there should be a deduction of fifty-two days for Sundays and 9 for holidays (61 days), leaving 304 effective days. This is actually a reduction of 16.7 per cent or 1/6. Further, for illustration, a large drayage business of just 200 horses must, of course, have from four to six driving horses for the use of managers and foremen in properly directing the work. There are spare horses or sick horses, which would bring the total of unproductive horses up to about 20, that is 10 per cent. Now, these driving horses must be fed and cared for, as well as the sick horses, and this takes off 10 per cent more from the 83 1/3 per cent left, which would leave exactly 75 per cent. Therefore, if it costs, as it does at present, $19.87 per month to feed a heavy draught horse, and there are 200 horses in the stable, it means an expenditure at present prices for oats, hay and other feed of $3,974; and to get the cost of keeping one draught horse effectively in the street per day, divide by the number of horses, and make an allowance for holidays, and this would be $0.90 per horse per day, from which you must not jump to the conclusion that any one claims a horse actually eats $0.90 worth of feed per day. What it actually eats is $0.66 at present prices, and the rest is added as his proportion of that food eaten by the idle horses, the sick horses, and that proportion of the holiday divided up on the working day."

The following table of costs covering both one and two-horse teams was included in the report:

	1-horse team.	2-horse team.
Driver's pay per day	$2.00	$2.50
Feed per working horse day	.90	1.80
Rent and stable expenses per horse per day	.31	.62
Shoeing and small repairs per horse per day	.19	.38
Claims, accidents, tools, etc.	.18	.36
Foremen's and lumpers' pro rata	.18	.36
Other helpers per horse per day	.20	.40
Repairs, harness and painting	.13	.26
Managers' or superintendents' salaries per day	.10	.20
Office rent, telephone and clerks	.31	.62
Miscellaneous, veterinary, etc.	.24	.48
Fire and accident insurance	.08	.16
Depreciation for renewals of horses	.20	.40
Total	$5.02	$8.54

In conclusion the accountant says: "It would seem from the above figures that any man that thought of letting a truck for $8 per day or less is cheating himself, and if he will look over these twelve items, he will claim, as he owns his stable he does not have to pay stable rent, and as he puts his own time in, perhaps, working fifteen to eighteen hours per day, he is saved managers' salaries; but is that an intelligent way to run a business, and is not the important business of transporting through the streets of a city like Boston millions of dollars' worth of costly goods and the largest amount of wool handled in any city in the world, with the possible exception of Liverpool, worthy of a position that will permit at least a 6 to 10 per cent return on capital actually invested, and a few hours' release from business cares for those employed in this most responsible calling?"

Two Hundred Per Cent Increase in the Motor Truck Industry

THE Commercial Vehicle Committee of the National Association of Automobile Manufacturers has just issued some statistics on the growth of the motor truck industry in 1912, and its probable growth during the present year. The output for 1912, as reported by 170 companies, was 21,939 commercial vehicles, as compared with 10,655 reported for the year 1911 by 85 companies, and 10,374 reported for all preceding years combined up to the end of 1910 by the same 85 companies. It is

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estimated that 10 per cent of the total production was not reported in 1912 and 25 per cent was not reported in 1911 and previous years. The total output would hence be 24,133 for 1912, as against 13,319 for 1911 and 12,968 for previous years, making a total output up to and including 1912 of 50,420. The estimate for 1913, based on the report of 170 companies, plus 10 per cent, is 56,744, which represents a growth of considerably more than two hundred per cent. The mean average price of all commercial vehicles produced in 1912 was $1,957.37. The average price of gasoline cars was $1,868.95 and of electric vehicles, $2,465.18. The average price of gas trucks in 1911 was $2,079.16, and in all preceding years combined $1,955.70, while the average price of all electric cars in 1911 was $2,759.66, and of all preceding years $3,369.72.

Motor Truck Researches at the Massachusetts Institute of Technology.

To the Editor of the SCIENTIFIC AMERICAN:

Remarks by Mr. John Ritchie, Jr., in the March 29th issue of the SCIENTIFIC AMERICAN have been noted by the writer.

We believe that the motor truck researches being conducted by the Massachusetts Institute of Technology are very thorough and sincere, but as Mr. Ritchie states that the bulk of the support for conducting these experiments and tests was furnished by electrical interests, we are inclined to believe that that was why the electrical figures appear so favorable.

We do know that there are over 400 Pierce-Arrow trucks in daily operation in various parts of the country, and none of them costs more per mile to operate than stated in the table published in your February 22nd issue. There are seventy of these trucks under the writer's personal supervision in this vicinity, and they all operate for less cost than mentioned in this table.

If the Massachusetts Institute of Technology were experimenting with old trucks or with new inefficient trucks, the high figures they get for gasoline trucks would be accounted for.

From the actual work done by Pierce-Arrow trucks in this vicinity, the tire cost per mile averages less than 5 cents.

ROBERT C. REID,
Manager Truck Department,
Harrolds Motor Car Company.

Overloading the Motor

By John R. Eustis

THERE is probably no one thing that will send a motor truck to the repair shop quicker than overloading. Overspeeding is about equally hard on the vehicle, but a driver can always know when he is exceeding the safe limit in this respect, while overloading is often done unconsciously.

The reason for this is that few operators know accurately the weights of the commodities which they transport on their vehicles. When horses were used this knowledge was unnecessary, for the behavior of a team always shows whether the load is too heavy for it.

A motor truck, on the other hand, will move a load a ton or more in excess of its rated capacity without showing the terrific strain to which it is being subjected. This strain will soon tell, however, and frequent trips to the repair shop inevitably follow.

To avoid overloading of motor trucks or any other type of commercial vehicle it is necessary to know the weight of each package or unit that is loaded on it. In some cases weighing platforms on which the loaded truck can be run are available, but then the tendency would be to "let her go this time," rather than remove part of the load.

There is, of course, always a margin of safety over the rated capacity of a motor truck, but it is not advisable to take advantage of it, and when unusually rough streets and steep grades are to be encountered, it is best to keep the weight under the rated capacity.

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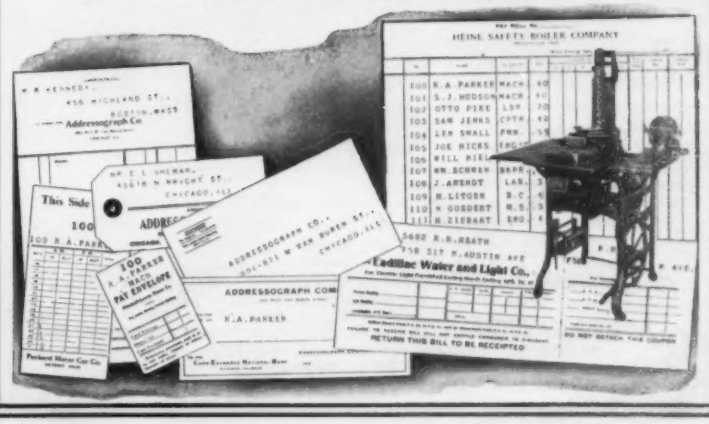
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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12785) T. A. P. asks: Is there any limit to the size a star might have, and if so, what fixes this limit? A. The magnitudes of stars were arbitrarily fixed at first. The twenty brightest were called first-magnitude stars; the faintest star visible with the eye, the sixth. At the present time the matter of magnitudes has been settled upon a mathematical basis. The fact was determined by Herschel that a first-magnitude star gave about 100 times as much light as one of the sixth magnitude. Upon this basis the ratio of the light of the several magnitudes has been fixed as the sixth root of 100; so that a sixth-magnitude star is taken as giving a unit of light; the fifth-magnitude star gives 2.5 as much, and in this way the first-magnitude star gives 100 times as much light as the sixth. This introduces fractional magnitudes, and negative magnitudes, for there are several stars which give more than 100 times as much light as is given by a sixth-magnitude star. Albebaran of Taurus is the only star of the even first-magnitude among the twenty stars formerly rated as of first-magnitude. We add the list of first-magnitude stars from Todd's "New Astronomy," price $1.45 postpaid.

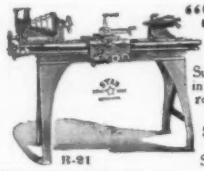
No.	Mag.	Name.
1.	−1.4	Sirius
2.	−0.8	Canopus*
3.	−0.1	a Centauri*
4	0.1	Capella
5.	0.2	Arcturus
6.	0.2	Vega
7.	0.3	Rigel
8.	0.4	Achernar*
9.	0.5	Procyon
10.	0.7	b Centauri*
11.	0.9	Betelgeuse
12.	0.9	a Crucis*
13.	0.9	Altair
14.	1.0	Aldebaran
15.	1.1	Spica
16.	1.2	Antares
17.	1.2	Pollux
18.	1.3	Fomalhaut
19.	1.3	Regulus
20.	1.4	Deneb

*Invisible in middle northern latitudes.

The size of a star cannot be determined directly. A star may be near and hot, and thus give much light. It may be remote and cool, and give little light although very large. When the distance of a star has been found, its size may be estimated on the basis that it is about of the same light-giving power as our sun or some other star.

(12786) G. S. asks: I would like to construct a wireless outfit for two different stations, so that we can pass some of our time experimenting. Now I have the secondary winding of a spark coil formerly used on an auto. It is in perfect condition as far as I know, and I would like to use this as the secondary winding on a transformer on a 110-volt circuit. I have tried winding the original coil with as much wire (about No. 24 double silk-covered magnet) as I could and get it inside the secondary, but it don't work. I can't get enough wire on it, and she heats up. Now I would like to know how much wire to put on my primary (and what size) to give me a 4- or 5-mile sending radius. A. Your best way to proceed in making a wireless telegraph outfit is to get Morgan's "Wireless Telegraph Construction for Amateurs," which we send for $1.50, and in that book you will find the description of every part of the whole apparatus with cuts, sizes, and directions for construction, so full and clear that you will save time and money by getting it. We should not advise the use of a telephone secondary for your coil. The wire is too fine and the coil too small for satisfactory service. It would serve to transmit a short distance, but we do not think it can reach 3 to 4 miles. Your primary has quite too fine wire also. No. 14 is probably the size you should use. Nor should you try to put 110 volts directly upon the primary. A resistance of lamps is best adapted for controlling the current, and will be cheaper in the end. You require such a guide as Morgan all along the way, and with it your own ingenuity will doubtless enable you to make a success of the outfit.

(12787) J. M. H. asks: Will you please tell me how to preserve leaves of bright color and keep their beauty? We have beautiful foliage plants here in Cuba, and I wish to know how to dry them with their colors. A. The secret of preserving the colors of leaves when dry is in drying them rapidly yet without heat. Heat will shrivel the leaves. Drying slowly will give time for decay to change the color. The best method we have found is to use blotting paper to absorb the moisture, and change the papers at least every day. It is better to change twice a day at first, and to use three or four sheets of blotters between each layer of leaves. Of course you will have a board on the top, and place a heavy weight on the board to press the whole. Be sure that the blotters are quite dry when they are put to use, and are dried each time thoroughly after removal from the press. A very watery leaf may be impossible of proper preservation.



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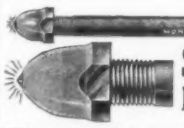

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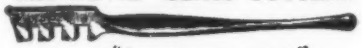

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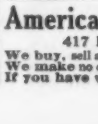

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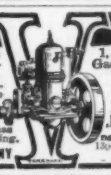

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THE INTERPRETATION OF RADIUM. Being the substance of six free popular experimental lectures delivered at the University of Glasgow by Frederick Soddy, M.A., F.R.S., Independent lecturer in physical chemistry and radio-activity in the University of Glasgow. With illustrations. Third edition revised and enlarged. New York: G. P. Putnam's Sons, 1912.

The previous editions of Mr. Soddy's excellent book on radio-activity have been so fully reviewed in these columns, that an extended notice of this third edition is hardly necessary. We can only repeat what we have already said, i. e., that the book is a model of straightforward, simple writing which is not only popular in style, but accurate in expression. Mr. Soddy has of course included accounts of the new discoveries and developments. The thorium series since the technical production of the new radio-active substances mesothorium and radiothorium now have a considerable and growing importance, for which reason they are considered at length. We are glad to see how cautiously Mr. Soddy handles the subject of the transmutation of elements, which has been thrust into public notice by extravagant newspaper accounts of Sir William Ramsay's experiments. On the whole, those who take an interest in the new chemistry, and who wish to read a conservative and yet popular account of the modern chemist's achievements in the field of radio-activity, will find Mr. Soddy's book eminently suited for the purpose.

THE GASOLINE ENGINE ON THE FARM. A practical, comprehensive treatise of the construction, repair, management and the use of this great farm power, as applied to all farm machinery and the farmer's work indoors and out. By Xeno W. Putnam. 179 illustrations. New York: The Norman W. Henley Publishing Company, 1913. Price, $2.50.

The uses for the gas engine are legion. It is the mechanical chore boy of the farm, the Percy or mechanical man of agriculture. It can be and is used in the house, in the barn, in the field and in the garden. There is hardly any place where there is work for a man to do that the gasoline engine cannot be used to advantage. On many American farms little engines may be found that vary in size from one and two horse-power to forty and sixty horse-power and that are used for almost every imaginable purpose. Just how extensive is this application of engines, it is difficult to state with any degree of certainty. No accurate statistics are available to show the actual number of farm engines in use, but the number must be huge. For example, in 1911 three companies alone made upward of 100,000 engines ranging in size from two to fifteen horse-power. Eighty-seven manufacturers report that they had sold since starting in business, 655,000 engines; while seventy-six firms reported early in 1912 that their requirements for the year were at least 705,000 engines. As nearly as we can determine, there are 750 manufacturers of gasoline and oil engines in the United States, and fully five hundred of these make a specialty of farm engines. Obviously it is time that some book should appear which is devoted to a subject of such vast importance; for the term "farm machinery" to the average man means simply ingenious harvesters, reapers, and binders. Mr. Putnam has performed a useful service in meeting what must be a real demand for a complete worker's handbook on the internal combustion motor and its agricultural applications. The applications of gasoline engines to farm and domestic work that he reveals are simply amazing. We can only wish that Mr. Putnam had omitted the rather fulsome praise of his work embodied on the title page.

PRACTICAL METHODS OF SEWAGE DISPOSAL. For Residences, Hotels and Institutions. By Henry N. Ogden, M. Am. Soc. C.E., and H. Burdett Cleveland, Assoc. M. Am. Soc. C.E. New York: John Wiley & Sons, 1912. 8vo.; 132 pp.; illustrated. Price, $1.50 net.

The work is particularly addressed to householders, and hence dispenses with all unnecessary technical terminology. It gives definite, practical information as to the construction of a small plant to successfully deal with the sewage from a country house. It does not seek to displace the engineer and the trained man in the handling of larger problems and unusual conditions. Directions are given for building and operating a settling tank, preferably cleaned out often enough to prevent septic action from taking place. However open to criticism such tanks may be from distinctly modern and up-to-date standpoints, they are at least preferable to the loose-walled cesspool so widely used. Sub-surface irrigation and sewage filters are dealt with in subsequent chapters of the work, and the final division is given over to estimates of cost.

ENGLISH SECTS. A History of Nonconformity. By W. B. Selbie, M.A., D.D. New York: Henry Holt & Co., 1912. 16mo.; 256 pp. Price, 50 cents net.

In fulfillment of the plan of its publishers, the Home University Library seeks to include within its scope every subject of vital and educational interest. This brief history of nonconformity, its origin and progress down to the present time, will be welcomed by the many for whom the subject has a real and deep appeal.

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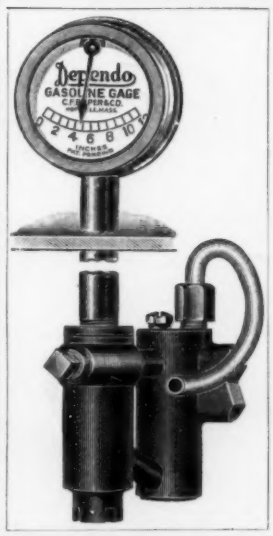

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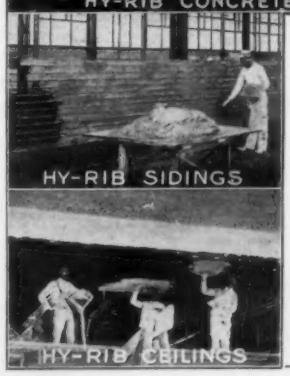

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RELENTLESS FRICTION

How it ruins automobile motors. How the remedy must be determined.

WITHOUT lubrication your car could run only about 20 to 30 times its own length.

Friction would then stop the power.

As oil saves power, it follows that one oil will save more power than another.

An important question is:

What oil will eliminate the most destructive friction in your motor?

Motors differ. Different cars demand different oils.

Only oil of the very highest lubricating qualities can properly protect the moving parts.

Only oil whose "body," or thickness, is suited to your feed system can properly reach the friction points.

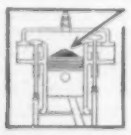
With such an oil, practically your only friction is the friction of oil against metal.

You will find this grade of oil indicated, opposite your car, in the chart printed in part on this page.

The recommendations in the chart were arrived at after a careful motor-analysis of the cars named. The oil's efficiency has been further proven-out by practical demonstrations.

If you use an oil of less correct "body," or of lower lubricating efficiency your motor must pay the penalty.

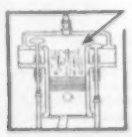
Some of the consequences are pointed out below.



Carbon Deposit (excepting that due to faulty carburetion and gasoline combustion) is commonly attributed to the *quality* of the lubricating oil. Quite as often the fault lies with the oil's "*body*."

In some motors, a light-bodied oil will work too freely past the piston rings, into the combustion chamber. Lubricating oil itself is a hydro-carbon product. Carbon can never be wholly filtered out. When the oil works freely into the closed combustion chamber, carbon deposit is bound to occur.

An unnecessary quantity of the oil is consumed. Ignition trouble, and in time, "knocking" of the motor results.

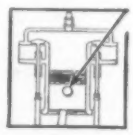


Another common result of faulty lubrication is **scored cylinder walls.**

The scoring is generally caused by the oil's low lubricating *quality*.

Or it may be caused by too-light a "*body*." In that case the oil fails to carry through to the end of the piston stroke.

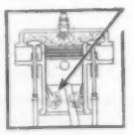
The piston rings then rub directly against the walls. In time they break. Scoring and scratching of the cylinders will result. Hissing of the motor follows.



A third result of wrong "*body*" or low lubricating *quality* is **worn wrist-pins.** This trouble causes a dull, metallic knock. In extreme cases the wrist-pins break.

A fourth result is **worn connecting rod or main bearings.** The unnecessary wear is caused either by the low lubricating *quality* of the oil, or by an oil whose "*body*" is unadapted to the fit of the bearings.

The bearings in different motors differ widely. For proper lubrication they require oils of different "*body*."



A fifth common result is **loss of compression and escape of the explosion.**

The oil's actual lubricating *quality* plays no part in this loss. The escape is attributable wholly to the oil's incorrect "*body*."

With certain types of piston rings a light-bodied oil forms too-thin a film around the ring. Loss of compression, escaping explosion, and reduced power result.

There is no plain symptom by which this escape can be discovered,—other than the lessened power of the motor.

TO avoid these troubles you *must* use an oil of the highest lubricating *quality*, and of correct "*body*."

There is only one way to determine the correct "*body*." That is, to carefully analyze the construction of the motor.

Any less-thorough method can only be a hazardous guess.

To meet this problem, each season we carefully analyze the motor-construction of every make of automobile.

Based on this analysis, and on practical experience, we determine the correct oil for each car.

The results of these conclusions are compiled in a lubricating chart—printed in part on this page. This chart specifies the correct grade of Gargoyle Mobiloil for your car.

The efficiency of the oils recommended has been thoroughly demonstrated in practical use.

In sheer lubricating *quality* they stand alone.

Oil of the *quality* and "*body*" recommended is an absolutely necessary step toward:

(1) The greatest horse-power efficiency.
(2) The smoothest operation.
(3) The fewest repair troubles.
(4) The lowest operating cost per mile.
(5) The longest life to your motor.
(6) The greatest second-hand value.

WE have here discussed lubrication with considerable assurance. You may wish to know more about the basis for this certainty.

We will speak plainly. Lubrication with us is both a business and a profession.

Throughout the world the lubricating counsel of the Vacuum Oil Company is sought by engineers who must meet the most rigid efficiency standards.

We are depended upon to determine the lubricating requirements and to supply the oils that meet them.

Our clientele includes thousands of manufacturing plants—located in practically every civilized country.

We supply the floating armament of the world's leading naval powers.

We supply practically all of the ocean greyhounds.

We supply the aeroplane fleets of the leading military powers.

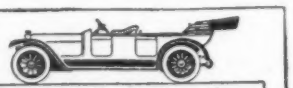
Outside of the home field we supply over seventy foreign automobile manufacturers.

OUR chart of recommendations represents our professional advice.

*If you use an oil of less-correct "**body**" or of lower lubricating **quality** than that recommended, unnecessary friction, unnecessary carbon deposit, loss of power, and ultimate serious damage must result.*

In buying Gargoyle Mobiloil from dealers it is safest to purchase a full barrel, half-barrel or a sealed five-gallon, or one-gallon can. Make certain that the name and our red Gargoyle appear on the container.

A booklet, containing our complete chart and points on lubrication, will be mailed on request.



Explanation: In the schedule, the letter opposite the car indicates the grade of Gargoyle Mobiloil that should be used. For example: "A" means "Gargoyle Mobiloil A." "Arc." means "Gargoyle Mobiloil Arctic." For all electric vehicles use Gargoyle Mobiloil A. The recommendations cover both pleasure and commercial vehicles unless otherwise noted.

MODEL OF CARS	1909		1910		1911		1912		1913	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Abbott Detroit			A	Arc	A	Arc	A	Arc	A	Arc
Akron	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
American	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Apperson	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Autocar (2 cyl.)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (4 cyl.)	A	E	A	E	A	Arc	A	Arc		
Avery			A	E	A	E	A	A	A	A
Benz	A	A	A	A	A	A	A	A	A	A
Buick (2 cyl.)	A	A	A	A	A	A	A	A	A	A
" (4 cyl.)	A	Arc	Arc	Arc	A	Arc	A	Arc	A	Arc
Cadillac (1 cyl.)	B	A								
" (4 cyl.)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cartercar	A	A	A	E	A	E	A	E	A	E
" Com'l.	A	A	A	E	A	Arc	A	Arc	A	Arc
Case							A	A	Arc	
Chalmers	Arc	Arc	Arc	Arc	A	Arc	Arc	Arc	Arc	Arc
Chase	B	B	B	B	B	B	B	B	B	B
Cole			Arc	Arc	A	Arc	Arc	Arc	Arc	Arc
Columbia	A	E	E	E	A	A	A	A		
" "Knight"						A	A	A	A	A
Couple Gear	A	A	A	A	A	A	A	Arc	A	Arc
Daimler	A	E	A	E	A	E	A	A	A	A
" "Knight"						A	A	A	A	A
Darracq	A	E	A	E	A	E	Arc	Arc	Arc	Arc
De Dion	B	A	B	E	B	A	B	A	B	A
Delaunay-Belleville	B		B	A	B	A	B	A	B	A
Elmore	A	A	Arc	Arc	Arc	Arc	Arc	Arc		
E. M. F.	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Fiat	B	A	A	A	B	A	B	A	B	A
" Flanders			E	E	E	E	Arc	Arc		
" (6 cyl.)									Arc	Arc
Ford	E	E	A	Arc	E	E	E	E	E	E
Franklin	B	E	B	Arc	A	Arc	A	Arc	A	Arc
" Com'l.	B	A	B	A	B	A	A	Arc	A	Arc
G. M. C.							Arc	Arc	A	Arc
Grabam					A	Arc	A	Arc	A	Arc
Grabam-Logan	A	Arc	A	Arc						
Herreshoff	A	A	Arc	Arc	A	Arc	A	Arc	A	Arc
Hewitt (2 cyl.)	A	A	A	A	A	Arc				
" (4 cyl.)	A	E	A	E	A	Arc	E	E	E	E
Hudson			Arc	Arc	A	Arc	A	Arc	A	Arc
Hupmobile "20"	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" "32"									A	Arc
I. H. C. (air)									B	A
" (water)									A	A
International	B	A	B	A	B	B	B	A		
Interstate	A	E	A	E	A	Arc	A	Arc	A	Arc
Isotta	A	A	A	A	A	A	A	A	A	A
Itala	A	A	A	A	A	A	A	A	A	A
Jackson (2 cyl.)	A	A	A	A						
" (4 cyl.)	A	E	A	Arc	A	Arc	A	Arc	A	Arc
Kelly					Arc	Arc	Arc	Arc		
Kelly Springfield									Arc	Arc
Kissel-Kar	A	E	A	E	A	Arc	A	Arc	A	Arc
" Com'l.					Arc	Arc	Arc	Arc	Arc	Arc
Kline Kar			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Knox	B	A	B	A	B	A	B	A	B	A
Krit			A	A	A	A	A	A	A	A
Lancia	B	A	B	A	B	Arc	B	Arc	B	Arc
Locomobile	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Lozier	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mack	A	E	A	E	A	E	E	E	E	E
Marion	A	E	A	E	A	E	A	Arc	A	Arc
Marmon	Arc	Arc	A	E	A	Arc	A	Arc	A	Arc
Matheson	Arc	Arc	Arc	Arc	A	A	A	Arc	A	Arc
Maxwell (2 cyl.)	E	E	E	E	E	E	E	E		
" (4 cyl.)	E	E	E	E	Arc	Arc	Arc	Arc	Arc	Arc
" (6 cyl.)									Arc	Arc
Mercedes	A	E	A	E	A	E	A	E	A	E
" "Knight"					A	A	A	A	A	A
Mercer			A	Arc	A	Arc	A	Arc	A	Arc
Michigan			Arc	Arc	A	Arc	A	Arc	A	Arc
Minerva "Knight"					A	A	A	A	A	A
Mitchell	A	A	Arc	Arc	A	Arc	A	Arc	A	Arc
Moon	A	E	A	E	Arc	Arc	Arc	Arc	Arc	Arc
National	A	Arc	A	A	A	A	A	A	A	A
Oakland	A	E	A	E	A	Arc	A	Arc	A	Arc
Oldsmobile	A	E	A	E	A	Arc	A	Arc	Arc	Arc
Overland	A	E	A	E	Arc	Arc	Arc	Arc	Arc	Arc
Packard	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Paige Detroit			E	E	A	Arc	A	E	A	E
Panhard	A	E	A	E	A	E	A	Arc	A	Arc
" "Knight"					A	A	A	A	A	A
Pathfinder									A	Arc
Peerless	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Pierce Arrow	A	Arc	Arc	Arc	A	Arc	A	Arc	Arc	Arc
" Com'l.					Arc	Arc	Arc	Arc	Arc	Arc
Pope Hartford	A	E	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Pullman	A	E	E	E	Arc	Arc	Arc	Arc	Arc	Arc
Rambler	A	A	A	A	A	Arc	Arc	Arc	Arc	Arc
Rapid	A	A	A	A	A	Arc	Arc	Arc		
Rayfield						A	A	A	A	A
Regal	A	E	A	E	A	Arc	Arc	Arc	Arc	Arc
Renault	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Reo	A	A	A	E	A	Arc	A	Arc	A	Arc
S. G. V.					A	B	B	B	B	B
Selden	A	E	A	E	A	E	Arc	Arc	Arc	Arc
Service					A	A	A	Arc	A	Arc
Simplex	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Speedwell	A	Arc	Arc	Arc	A	Arc	Arc	Arc	Arc	Arc
" "Mead"									A	Arc
Stanley	D	D	D	D	D	D	D	D	D	D
Stearns	A	A	Arc	Arc	A	Arc	A	Arc		
" "Knight"							A	A	A	A
Stevens Duryea	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Stoddard-Dayton	E	E	Arc	Arc	A	A	A	A	A	A
" "Knight"							A	A	A	A
Studebaker	A	E	E	E	A	Arc	Arc	Arc	A	Arc
Stutz							Arc	Arc	Arc	Arc
Thomas	E	E	E	E	E	E	A	E		
Waiter	A	E	A	E	Arc	Arc	Arc	Arc	Arc	Arc
Warren Detroit			Arc	Arc	A	A	A	A	A	Arc
White (Gas)			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Steam)	D	D	D	D	D	D	D	D	D	D
Winton	E	E	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc

GARGOYLE

Mobiloil

A grade for each type of motor

The various grades of Gargoyle Mobiloil, refined and filtered to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "D"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

They can be secured from all reliable garages, auto supply stores and others who supply lubricants.

VACUUM OIL COMPANY, Rochester, U. S. A.

BRANCHES:

NEW YORK	BOSTON	DETROIT	CHICAGO	PHILADELPHIA	INDIANAPOLIS
29 Broadway	49 Federal St.	Ford Bldg.	Fisher Bldg.	4th & Chestnut Sts.	Indiana Pythian Bldg.

Distributing warehouses in the principal cities of the world